AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off

Published Weekly

Volume 73 Number 22

Contents

C. A. MUSSELMAN, Pres. and Gen. Mgr.; J. S. HILDRETH, Vice-Pres. and Manager; W. I. RALPH, Vice-Pres.; G. C. BUZBY, Vice-Pres.

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FRITZ J. FRANK, *Executive Vice-President*
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AUTOMOTIVE INDUSTRIES

Vol. 73, No. 22 — *Thirty-seventh Year* — November 30, 1935

W-O Bondholders Get 70% Offer

New Reorganization Plan Includes Claim Purchase, Litigation Elimination

Special to AUTOMOTIVE INDUSTRIES

An effort to reorganize the Willys-Overland Co. will be based upon the elimination of litigation between bondholders and general creditors through a plan by which Empire Securities, Inc., a Delaware corporation, will acquire by purchase at least 67 per cent of claims and bonds.

Empire Securities, Inc., is represented by George W. Ritter, who served as personal attorney for the late John N. Willys. It is understood that Ward M. Canaday, president of the U. S. Advertising Corp., is interested in the company. Toledo financial circles incline to the belief that the Willys estate may be interested in the general plan as a means of saving its large investment in the preferred stock of Willys-Overland, the security now controlling the corporation.

There are $2,000,000 of the 6½ per cent first mortgage bonds due Sept. 1, 1933, outstanding and in default. At the close of last year unpaid and accrued interest was $84,420. A payment of $250,000 has been made by the receiver to National City Bank, trustee, out of funds derived from sale of surplus machinery.

Under the purchase offer Empire Securities, Inc., will pay 70 for the bonds and also agrees, if it can purchase 67 per cent of them, to pay for them on Jan. 10, 1936, and advance $50,000 in full settlement of expenses of the bondholders' protective commit-

(*Turn to page 711, please*)

Syracuse to Foreclose On Franklin for Taxes

Mayor R. B. Marvin has announced that the City of Syracuse, N. Y., would immediate institute foreclosure proceedings against Franklin Motors, Inc., on account of unpaid city taxes. The total tax bill amounts to $381,860, of which $373,651 is on the factory.

The city had made an agreement with the company, it is reported, by which 40 per cent would be taken from the tax bill on condition the company began reemploying workmen and started manufacturing operations. The company has not fulfilled its share of the agreement, according to the Mayor. Franklin Motors, Inc., acquired the property of the H. H. Franklin Manufacturing Co. in 1934.

Accent on Silence

OEUVRE, PARIS

Encouraged by the success of New York in reducing the noise-level of the city during rest hours, other cities throughout the United States and Europe plan police-enforced noise elimination compaigns. The motor vehicle comes in for a lot of attention during such campaigns . . . offering advertising possibilities for new cars with better-than-average silence characteristics.

Labor Situation Production Key

Current High Rate Continuation Hinges Upon Supply Sources

by Harold E. Gronseth

Detroit Editor, AUTOMOTIVE INDUSTRIES

Unless labor troubles interfere, the current high rate of operations of motor car manufacturers will continue through December, according to present plans. The final month of the year may even top the November output by a small margin since several plants were not in full stride during the first half of the month just closing and others, having attained good volume, are further accelerating their pace.

The two weeks old strike at one of the leading plants has had no discernible effect on assembly operations. Car manufacturers were fortified with ample stocks of parts to carry them until their requirements could be handled by other sources. Instances are rare where a car maker now trusts to a single source for supplies of any

(*Turn to page 710, please*)

Cleveland Motor Workers' Delegates Confer With Lewis on Vertical Plan

Delegates of two Cleveland locals of the A.F.L. Automobile Workers' International Union were in Washington Tuesday conferring with John L. Lewis, president of the United Mine Workers of America and chairman of the newly formed Committee for Industrial Organization, over plans for extending the Lewis committee's campaign for vertical unionism in Cleveland. The industrial committee's principle of vertical organization was endorsed by the Cleveland Federation of Labor last week and is not being actively opposed as yet by craft organizations in that city.

Cleveland labor sympathies toward industrial forms of organization have been built up by the apparently successful combination of industrial and craft methods through the Cleveland Metal Trades Council, of which James McWheeny is president. Where agreements have been made with employers the contracts are between the company and the Metal Trades Council, not with numerous separate crafts. Jurisdictional questions have been held to a minimum under this arrangement, according to employers' statements as well as union officers'. The assertion is made in Cleveland, though not over union men's names, that the Lewis-Green dispute need not have occurred if these methods had been nationally understood by organized labor.

The new A.F.L. automotive union is drawing upon a group of possibly 10,000 members or former members of federal unions of the A.F.L. These include the 3000 White Motor members represented by Wyndham Mortimer, and several hundred employees of the Baker-Raulang Co., body manufacturers, represented by Elmer Davis, both

(*Turn to page 710, please*)

In This Issue

Goodyear Workers Place Wage-Hour Woes Before Perkins' Fact-Finders

The special three-man fact-finding commission named by Secretary of Labor Frances Perkins to investigate the wage and hour dispute between employees and the management of the Goodyear Tire & Rubber Co., at Akron, Ohio, is expected to file its report with the Department of Labor by Dec. 1. With Dr. Fred C. Croxton of Columbus, Ohio, former member of the State Public Utilities Commission, as its chairman, the board opened its Akron sessions Nov. 23. Dr. John A. Lapp, member of the Petroleum Labor Policy Board, has been substituted for Major J. I. Miller of Washington, who was originally appointed. The third member is Hugh S. Hanna of the Department of Labor.

The dispute involves the reported plan of Goodyear to change its factory schedule from four daily 6-hour shifts to three 8-hour shifts. Employees through officers of the Goodyear local, United Rubber Workers' Union, A. F. L., were first to present their case to the board. Among labor representatives at the opening hearing were Sherman H. Dalrymple, president of the United Rubber Workers of America; John House, president of the Goodyear local; W. W. Thompson of the Firestone local, and members of the executive committee of other locals.

After conferring with Goodyear officials and learning their side of the controversy, the board met with a special committee of the Goodyear Industrial Republic, which is the employees' assembly patterned after the National Congress.

Goodyear officials laid before the board a series of charts and tables similar to those presented at employee meetings by P. W. Litchfield, president. These charts show an excess production and distribution capacity in the United States, with an increase of tire distributing outlets from 75,000 in 1929 to 185,000 this year, largely through the increased sale of tires by petroleum companies through their many thousands of stations throughout the country. Goodyear contended that production capacity in the United States is 68,000,000 tires per year as against a market for less than 50,000,000 and also contended that "bottom" had not yet been reached in consumer tire buying. C. Slusser, vice-president, presented figures to show that Goodyear payrolls composed 28 cents out of every Goodyear dollar in 1934, as compared with only 21 cents in 1929. He estimated a market for 48,300,000 tires in 1936, including 29,000,000 for replacement purposes, 18,000,000 for original equipment, and 1,300,000 for export. This year replacements are running between 29,500,000 and 30,000,000, it is estimated.

Ingot Output Gains 30% Over Year Ago

Automotive Requirements Chief Factor in Increase; Higher Prices Imminent

Announcement on Tuesday by the leading interest that prevailing prices for hot-rolled and cold-finished sheets would apply to first quarter business served to upset the price program of independent producers, but the latter say that while it may be deferred it certainly has not been abandoned.

The hoary problem of the priority of the egg or the chicken has been resurrected in the steel market by way of proving or disproving that progress in automotive manufacture has made possible corresponding progress in mass production of meritorious steels or whether such innovations as the continuous rolling mill in steel metallurgy brought about the high degree of efficiency in present-day automobile production.

If cold statistics as to increased demand are to be accepted as a criterion, those just published by the National Association of Flat Rolled Steel Manufacturers, showing sales by its members of 226,000 tons in October, equal to 74.6 per cent of capacity, and unfilled tonnage on Nov. 1 of 211,452 tons or 69.8 per cent of capacity, furnish an impressive prop for higher price arguments. While the picture of automotive consumption of steel is by far a more cheery one than that of the steel industry's condition as a whole, it seems now to be accepted as a fact that ingot production in 1935 will be somewhere between 33,500,000 and 34,000,000 tons, denoting a gain of approximately 30 per cent over last year's record.

It may be some comfort to those who foot the steel bill that so far prices have not reflected this upward change in consumption and that when one accepts the traditional rule of increased demand justifying higher prices, the advances overhanging the market's price structure appear normal. Steel producers are confident that volume of demand will in no wise be affected by whatever price changes may come to pass. In fact, some say that a very heavy tonnage for first quarter booking has been tentatively decided upon by large buyers for placing as soon as first quarter books are opened.

Pig Iron—A larger number of automotive foundries are covered over the remainder of the year and some will carry quite a little iron into the new year. The markets are marking time at unchanged prices.

Aluminum—Firmness is the outstanding characteristic of the markets for primary as well as secondary metals and alloys. Piston metal is in good demand.

Copper—Although rumors of an impending rise were freely circulated at the beginning of the week, the market remained unchanged on Monday, electrolytic being quoted at 9¼ cents, delivered Connecticut point. Domestic inquiry of late has been impressively heavy and a rise in price to 9½ cents would hardly come as a surprise.

Tin—Demand for spot Straits tin continues active, 51 cents being the general quotation, unchanged from last week's close. Second quarter metal can be had at 48¼ cents.

Lead—Fairly active and unchanged.

Zinc—Firm and unchanged.

A New York department store advertisement capitalizes a popular modern travel mood to attract customers and build sales

October New Car Sales Index 64 to Sept.'s 51

The preliminary adjusted index of the value of retail sales of new passenger cars, issued by the Department of Commerce, shows an increase from 51 in September to 64 in October, based on the 1929-1931 averages as 100. The rise in October was undoubtedly due to the much earlier introduction of new models this year.

Daily average sales, without seasonal

adjustment, increased about 2 per cent from September to October, contrasted with a usual decrease of about 18 per cent. Compared with previous years, sales in October were 8 per cent higher than in the same month of 1934 and 20 per cent above October, 1933. The aggregate value for the first 10 months of 1935 was 31 per cent above the same period of last year and 74 per cent higher than in 1933.

Chicago's "Mistake" Proves Biggest Show

Statistics Reveal Sales, Attendance and Wholesale Orders Responded to Plan

Manufacturers and others who had frowned on Chicago's show policy of "Everything under one roof, with no private displays at hotels," were convinced before the week was over that a new pattern had been cast for automobile shows of the future. Previously private showings had been looked to as the big attractions with the show itself as a necessary instrument for publicity.

Before show week ended everybody was agreed that the place to show off new models is at the show.

Nearly everything that had been called a mistake contributed to Chicago's phenomenal success. Holding everything under the one roof, the fur fashion display, moving from the Coliseum to the Amphitheater had all been called mistakes.

But here's some statistics to show what actually happened:

The attendance was 424,000, twice the attendance at the show in February and claimed to be an all-time high for automobile shows.

Floor salesmen sold 2,500 cars, a 45 per cent increase over February, for a total retail value of $2,125,000. This was an average of $850 per car, showing that the medium and high-priced fields had a high demand. Visiting dealers who took in the show increased their wholesale orders for over $2,000,000 worth of cars.

Fruehauf Gets Order For 550 Trailers

Orders for building 550 trailers for the Keeshin Transcontinental Freight Lines, a new nation-wide trucking system with headquarters in Chicago, have been received by the Fruehauf Trailer Co. The company has recently added a large body plant to its manufacturing facilities.

Cleveland Welding Control Passes from Motor Wheel

A stock purchase agreement has been completed by which the controlling interest of the Cleveland Welding Co. has been returned to the same Cleveland parties that held control prior to the company's affiliation five years ago with the Motor Wheel Corp., according to an announcement made by H. W. Kranz, president of the company. The Cleveland Welding Co. has specialized in the manufacture of circular products, such as rims, wheels, electric motor frames and gear ring blanks, since 1911.

Japanese Motor Company To Build 8 Cylinder Car

Production of the "Rokko," a new eight-cylinder passenger car, is planned by the Kawasaki Sharyo K. K. (Kawasaki Vehicle Co., Ltd.) of Japan, according to reports from the U. S. Trade Commissioner in Tokyo. The new car will be built in sedan and phaeton models with a wheelbase of 3.24 meters (127½ in.), overall length of 4.86 meters (191 in.), weight empty of 2250 kgs. (5000 lb.), and a rating of 66 hp. at 1800 r.p.m. The bore and stroke will be 81 mm. x 115 mm. (3 3/16 in. x 4 17/32 in.).

New Harvester Plant Begun

Contract for a new building at the Springfield motor truck works of the International Harvester Co. has been let to A. G. Samuelson, Inc., of Springfield. The building is expected to be completed about Feb. 15. The new building is the principal item in a $750,000 plant expansion program announced four months ago.

Austin and Associates Counter British Steel Price Rise With Own Company

Special Cable to AUTOMOTIVE INDUSTRIES

Some British industrial interests, headed by Sir Herbert Austin, automobile manufacturer, have moved against the National Government's new tariff on steel and the consequent price increase with plans for the construction of a steel plant of 100,000 tons annual capacity at Wolverhampton, England.

On the only information available in London, Sir Herbert and his associates alone are reported interested in the new company formation. The concern, it is understood, will be financed with share and debenture capital of about 800,000 pounds sterling (approximately $4,000,000). A site has been acquired, but no information is available at this time concerning the date when the new plant will be completed or initial production begun. The production capacity of the new plant, 100,000 tons annually, is about one-sixth of the total quantity supplied yearly to the automobile industry in Great Britain and less than 1½ per cent of the total national production of finished steel.

Lord Nuffield, manufacturer of the Morris car, joined in the general denunciation of British steel makers for raising their prices behind the tariff wall, adding that were he a young man he, too, would start his own steel works. At the present time the British automobile industry is consuming around 650,000 tons of finished steel annually. Lord Nuffield and Sir Herbert have claimed that one of the handicaps to expansion of British automobile trade abroad has been the steel prices.

Sir Herbert Austin

Fewer Insolvency Cases Mark Industry's Recovery

A new low is likely to be set for the number of failures in the automotive business this year. During the first nine months there were only 211 recorded failures of manufacturers, wholesalers and retailers of automobiles, supplies and accessories, compared with 234 during 1934, which was the lowest on record, according to Dun and Bradstreet.

The complete insolvency record of the industry since 1930, including the first 10 months of 1935, follows:

MANUFACTURERS

(Automobiles, Automobile Supplies and Accessories)

Year	Number	Liabilities
1930	196	$5,410,562
1931	114	2,832,260
1932	115	10,905,517
1933	34	972,514
1934	24	3,307,455
1935*	16	331,474

WHOLESALERS AND RETAILERS

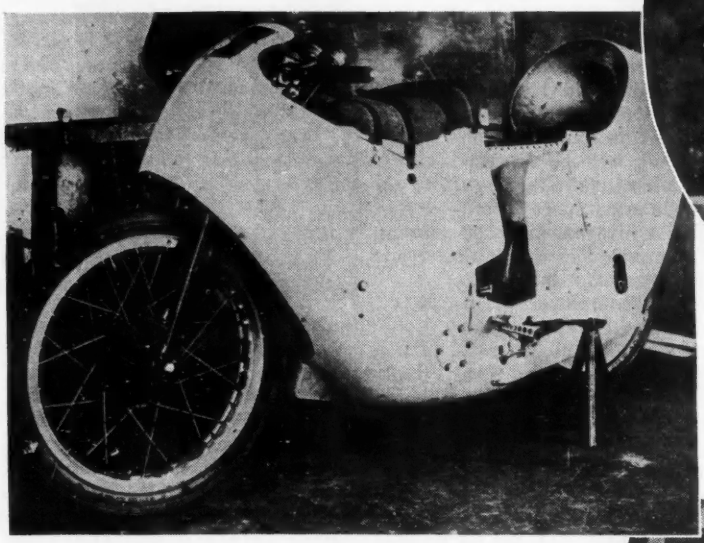
(Automobiles, Automobile Supplies and Accessories)

Year	Number	Liabilities
1930	1,155	$23,733,170
1931	824	15,895,764
1932	872	27,441,884
1933	357	9,509,054
1934	210	5,098,997
1935*	195	3,169,213

*January to October, inclusive.

The World On Wheels

Acme Photo



Rome's National Aeronautical Co. designed and produced this "stream-lined" motorcycle and with it won many prizes. The cycle is said to have a maximum speed of 157 m.p.h.

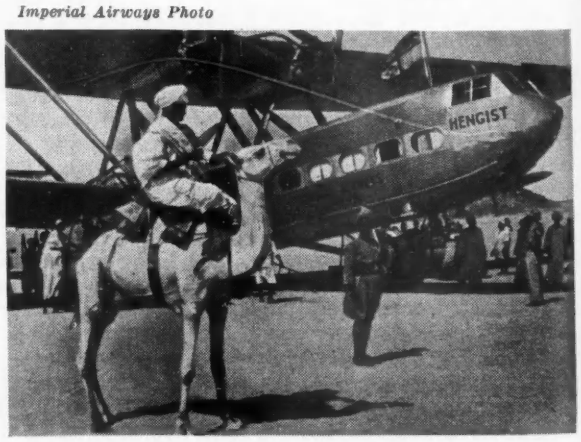
These dogs ride to the hunt in deluxe manner. Special ventilators built into the walls of the trunk on the rear of a Chevrolet let in plenty of fresh air, but no drafts reach the dogs.

An American car for Ethiopian Red Cross. Standing left to right are Harwood B. Catlin, Dr. William J. Schieffelin, Major-General John F. O'Ryan and Murray Jacoby. All interested in humanitarian aid for Ethiopia.

Acme Photo

Wig-wag beacons on each rear corner of truck give brilliant, steady glow while running and flash intermittently when speed is reduced.

Imperial Airways Photo



The centuries spanned in transportation. A 38-seater Handley-Page transport plane of the Imperial Airways which flies regular schedule routes in India.

British Vehicle Output of 397,681 For 12 Months Sets New High Record

During the year ended Sept. 30 last, British motor vehicle production broke all previous records, according to figures of the Ministry of Transport. The total for this period was 397,681, compared with 337,647 during the previous 12-month period.

Passenger cars produced amounted to 307,299, compared with 254,058, and commercial vehicles 90,382, against 83,589, an increase of 20.9 per cent for the former and 8.1 per cent for trucks and buses.

Car sales kept pace with increased production, the total for the year ending Sept. 30, 1935, being 341,124, of which 266,634 were passenger vehicles, and 74,490 commercial. During the previous year total sales were 286,063, with 215,525 passenger cars, and 70,538 commercial vehicles. Sales for the past year in Northern Ireland were 6,480, and the year before 5,058 units. The increase of sales in Great Britain this year was 19.2 per cent.

A big drop in car imports into Great Britain from the United States and Canada was registered in August, according to British figures. During August this year imports from the U. S. amounted to 249 units valued at £40,588, against 959 valued at £152,652 during August, 1934. From Canada, only three cars valued at £446 were imported in August, against 467 valued at £61,659 during the same month a year ago. The decrease was largely due to seasonal factors, together with the fact that the new American model announcements came earlier this year.

Reo Given Government Order for 1199 Trucks

Reo Motor Car Co. has received an order for 1199 trucks from the United States Government, according to D. E. Bates, president and general manager. The order calls for immediate delivery of 920 2-ton dump trucks and 279 1½-ton dump trucks for the Department of Agriculture and amounts to well over $1,000,000. This is one of the largest orders ever received by Reo. Production lines are now working at top speed to fill truck orders and to take care of demand for new 1936 Reo Flying Clouds.

Studebaker Belgian Plant In Full Production Swing

Studebaker's recently inaugurated assembly operation in Belgium is now in full production, Paul G. Hoffman, president, Studebaker Corp., announced on his return from a brief European trip during which he visited Belgium, Holland and England. Arvid Frank, president, Studebaker Export Corp., accompanied Mr. Hoffman on the trip.

Several hundred distributors came from all parts of Europe to a special sales meeting which Mr. Hoffman and Mr. Frank addressed in Brussels on Nov. 16.

The new Belgian assembly plant is being operated by D'Itieren Freres, European carriage builders, who are now Studebaker distributors at Brussels. Cars from this plant, which performs about the same mechanical functions as do the Studebaker assembly branches in Canada and Los Angeles, will supply cars for the active Belgian market.

Following the Brussels meeting, Mr. Hoffman spent several days conferring with Studebaker representatives at The Hague and in London. In all of the areas visited, Mr. Hoffman said, the sales outlook in excellent.

MEWA to Grade-Classify Manufacturers' Policies

A plan for grading and classifying manufacturers' selling policies will be presented to members of the Motor and Equipment Wholesalers Association at the annual convention Dec. 6 and 7 in Atlantic City, according to a statement from the association's headquarters at Chicago.

W. H. Beal

New board chairman of the New York Shipbuilding Corp. succeeding L. B. Manning, Cord president, resigned.

Abbott Forms Research Co.

E. J. Abbott, formerly research physicist with the University of Michigan, and recently the author of a number of papers of interest to automotive engineers', has formed the Physicists Research Co., Ann Arbor, Mich., in which he will serve as president. The company will specialize in "the application of modern physics-tools to industrial problems."

See AUTOMOTIVE INDUSTRIES, Mar. 30, 1935—p. 444.

See *S.A.E. Journal*, Mar., 1935—p. 112.

October's Car-Truck Output Triples Sept. Total; 3,349,790 in 10 Mos.

November shows and a continuing retail demand for new cars boosted October's passenger car and truck production in the United States and Canada to approximately three times the September volume. With September output sagging to the year's low point, due to shut-downs for change over purposes, October rebounded and showed a total production of 283,334 units, against 95,128 for the previous month.

Some substantial evidence that 1935 may turn into a 4,000,000-unit year is borne out by the 10 months' output record. At October's close the total production stood at 3,349,790 units comparing with 2,628,466, an approximate 300,000-unit gain over the preceding comparable period of 1934. Coupled with this volume will be the rush at factories to keep abreast the constantly mounting bank of dealer orders, lending further weight to the belief that the year's final quarter will roll up a 900,000-unit output volume.

	October, 1935	September, 1935	October, 1934	Ten Months, 1935	Ten Months, 1934
Passenger Cars—U. S. and Canada:					
Domestic Market—U. S.	195,568	49,905	.....	2,406,271	.....
Foreign Market—U. S.	19,041	7,380	.....	196,527	.....
Canada	7,128	3,819	2,125	116,330	89,152
Total	221,737	61,104	86,128	2,719,128	2,106,990
Trucks—U. S. and Canada:					
Domestic Market—U. S.	47,111	25,028	.....	473,178	.....
Foreign Market—U. S.	13,301	7,492	.....	128,090	.....
Canada	1,185	1,504	1,655	29,394	23,309
Total	61,597	34,024	49,643	630,662	521,476
Total—Domestic Market—U. S.	242,679	74,933	.....	2,879,449	.....
Total—Foreign Market—U. S.	32,342	14,872	.....	324,617	.....
Total—Canada	8,313	5,323	3,780	145,724	112,461
Total—Cars and Trucks—U. S. and Canada	283,334	95,128	135,771	3,349,790	2,628,466

Used Car, Factory-Dealer Problems Engage NADA

The used car problem and factory-dealer contracts for 1936 were held to be the two paramount issues confronting the car dealers, according to the consensus of the feelings expressed at the conference of the National Automobile Dealers' Association in Chicago. These matters were discussed by various speakers, the former even assuming an international aspect when it was explained how the used car problem is controlled in Germany.

The 250 dealers who attended the conference were told by Jack Frost, NADA general manager, that the used car guide, published by the national body during the NRA, would be continued. He said the guide book has been endorsed for future use by virtually all car manufacturers.

Concerning the new factory-dealer relationships, James Dalton, editor of *Motor* magazine, told the dealers that the contracts for next year will be of minor significance in comparison with the individual factory policies. He said that whereas it is not likely all manufacturers would write into their 1936 contracts a clause similar to the General Motors cancellation clause, most of them would give dealers every consideration in that regard.

F. W. A. Vesper, president, presided at the meetings. Speakers were C. E. Gambill, director of the national body; K. K. Kenderdine, head of the Chicago Auto Trades Association; E. M. Lied, vice-president of the NADA; Hon. William McCraw, attorney general of Texas; Dr. Alphonse Reuss, head of the Automobile Dealers Association of Germany; W. B. Buress, trade counselor and speaker.

Waste Labor Elimination Impresses British Visitors

Charles F. Breeden, chairman and managing director of Wilmot-Breeden, Ltd., and S. E. Myrans, executive of the same firm, Birmingham, England, together with Percy H. Mills, managing director of W. & T. Avery, Ltd., Birmingham, were guests of Toledo industrial leaders.

Mr. Breeden, whose company makes bumpers, said he was greatly impressed with the speedy production and few types of bumpers made in American plants. He said his own firm makes 8000 sets of bumpers a week but has to work on 125 different patterns. Reduction of unproductive labor to the minimum, application of science to industry, analysis of operations and gigantic industrial conceptions impressed him on this first visit.

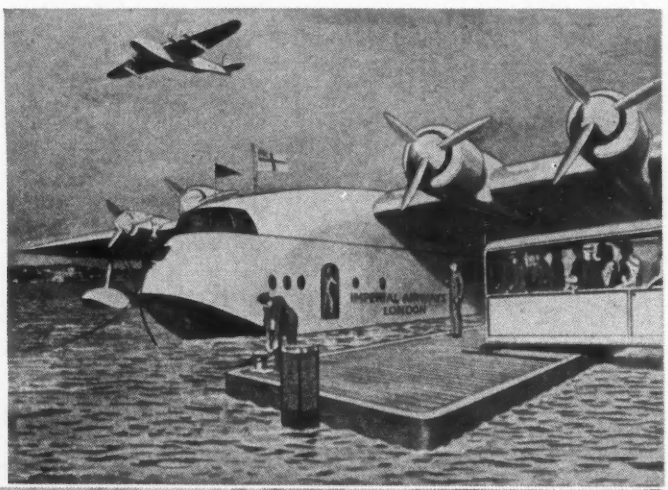
Planes to Carry All Letter-Mail Throughout British Empire

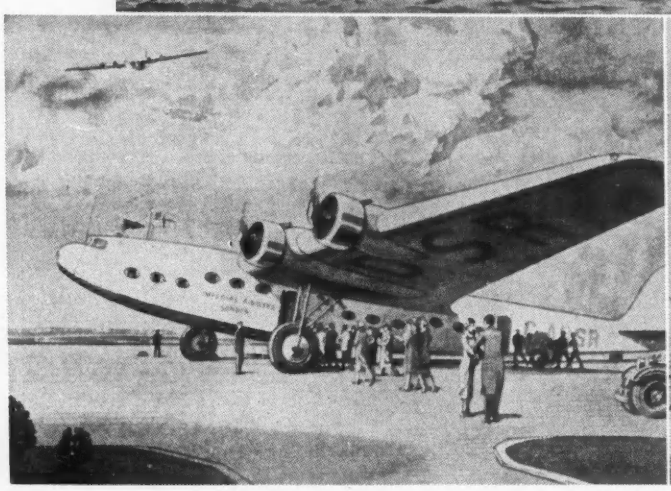
Imperial Airways Has Three Radical New Types Under Construction

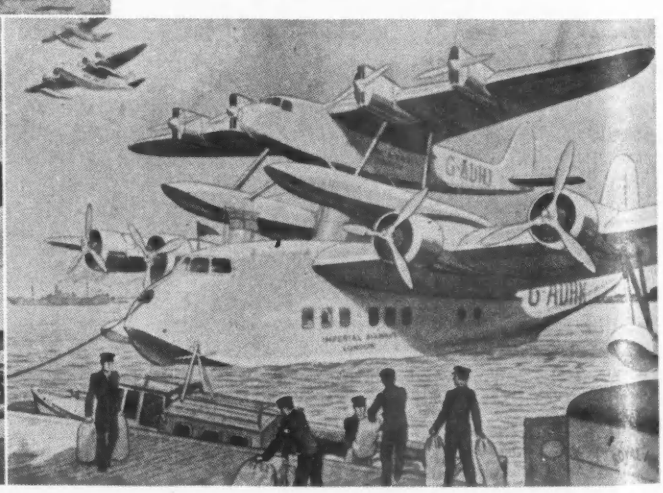
Letter mails within the British Empire will, in the future, be carried by air as far as practicable. This and other statements of broad interest are contained in the speech of Sir Eric Geddes, chairman of Imperial Airways, at the eleventh annual meeting of the company held in London at the end of October.

During the fiscal year ended March 31, 1935, the company carried in its seven flying boats and 30 land-planes 3,511,528 traffic ton-miles (including the weight of passengers, mails, baggage and freight), as compared with 2,733,603 traffic ton-miles for the corresponding period of 1934. Steady increase in the traffic ton-mile figure has been recorded for each year (except 1931) of the company's operation.

As of October, 1935, the fleet of Imperial Airways included 7 flying boats (total horsepower 12,480) and 35 land-planes (total horsepower 43,140). New aircraft under construction number 5 and appear in the totals above. Twenty-nine flying boats and 12 land-planes not included in the above figures are also on order or beginning construction.







(Top) New Empire flying-boat under construction for Imperial Airways by Short Bros., Ltd.

(Left) New airliner under construction by Sir W. G. Armstrong Whitworth Aircraft, Ltd.

(Right) Mayo composite-aircraft under construction for Imperial Airways by Short Bros., Ltd.

FTC Cites Winslow For Unfair Practice

Dallas E. Winslow, Inc., of Detroit, trading as Durant Motor Car Co., has been served with a complaint issued by the Federal Trade Commission charging unfair competition in the sale of parts and accessories. The Winslow company's adoption of the trade name, according to the complaint, came about following its purchase of all unassembled parts on hand and other assets of the former Durant Co. from the Fuller-Johnson Corp. Adopting the trade name, Durant Motor Co., the Winslow firm is alleged to have begun selling replacement parts for the Durant, Star and Rugby automobiles. Subsequently the supply of these parts became depleted, and the company then began ordering them from other manufacturers, according to the FTC, until the supply of parts consisted largely of parts not derived from the original Durant Co.

Firestone Sells Subsidiary To U. S. Rubber Products

The Firestone Tire & Rubber Company announced the sale of its rubber footwear subsidiary, the Firestone Footwear Co., of Hudson, Mass., to the United States Rubber Products, Inc., for a consideration of "slightly less than $3,000,000."

Report Briggs Buys Johnson Motor Co.

Stephen Briggs, chairman of the board of both Briggs and Stratton and the Outboard Motors Corp., is reported to have purchased the controlling interest in the Johnson Motor Co., which operates a plant at Waukegan, Ill.

Structural Failure Not Cause of Boeing Crash

The report of the Army Air Corps board that investigated the crash of the Boeing bomber at Dayton a short time ago indicated no structural or functional failure was responsible for the accident.

Chevrolet Gas Consumption Low in 100,000 Mile Test

Two Chevrolet cars used by Atlantic Refining Co. as part of a fleet for a protracted road test of 100,000 miles had records of 21.9 and 21.6 miles per gal. of gasoline and averaged more than 500 miles per quart of oil.

Budd Wheel to Pay Preferred Dividend

The Budd Wheel Corp. has announced an accumulation dividend distribution of $5.25 a share on the 7 per cent preferred stock, payable Dec. 31 to stock of record Dec. 18. The amount is payable on account of all accumulations.

H. F. Howard (left), who has been manager of the Chevrolet assembly plant at Flint, turns over the operation to his successor, Dudley G. Frazier, formerly plant superintendent at Baltimore. Mr. Howard has been appointed plant manager at Baltimore

Industry Can't Absorb All Jobless, Coyle Says

Industry, which never had more than 12,000,000 employed, should not be asked to take 10,000,000 of the unemployment rolls, M. E. Coyle, president of Chevrolet, told members of the Detroit Rotary Club at a recent luncheon. "Mechanical industry cannot bear all the burden because these unemployed persons came largely from other brackets, such as clerical, transportation, agricultural, household and the like," he explained. "We are not trying to take anything away from the laboring man, but we must protect work for him, even if he doesn't see it," he said.

Henry Reelected President of AAA

The American Automobile Association, in its annual convention of directors and counselors held in Chicago, re-elected Thomas P. Henry, Detroit, to serve his 13th term as president.

Chief among the matters which were discussed was the widespread and growing diversion of road funds and automobile tax money to other purposes. The convention passed several resolutions denouncing the practice on the parts of the states.

Other officers elected to serve with Mr. Henry were:

First vice-president—Charles M. Hayes, president, Chicago Motor Club, Chicago.

Second vice-president—S. Edward Gable, president, Pennsylvania Motor Federation, Lancaster, Pa.

Third vice-president—Sam W. Burchiel, president, Automobile Club of Rhode Island, Providence, R. I.

Fourth vice-president—R. R. Reynolds, U. S. Senator and director of the Carolina Motor Club, Asheville, N. C.

Fifth vice-president—Frank E. Whittemore, president, Ohio State Automobile Association, Akron, Ohio.

Sixth vice-president—J. Mack Young, president, New York State Automobile Association, New York City, N. Y.

Seventh vice-president—Arthur H. Reed, president, California State Auto Association, Oakland, California.

Secretary—Charles F. Foley, past-president, New York State Auto Association, Lockport, N. Y.

Treasurer—George W. White, president, National Metropolitan Bank, Washington, D. C.

Briggs Buys Tigers

Walter O. Briggs, president Briggs Manufacturing Co., has become sole owner of the Detroit Tigers Ball Club, having exercised his option to buy the half interest owned by Frank J. Navin.

Industrial Development Based Upon Farm Expansion Visualized by Hale

U. S. Rubber Products was host last week to the Detroit Chapter of the National Association of Cost Accountants. The program included dinner at the factory and a tour through the tire manufacturing division after the technical session.

The principal speaker, Dr. Wm. J. Hale, research chemist, the Dow Chemical Co., elaborated on his favorite topic — the Farm Chemurgic — which proposes that all industrial development of the future should be based upon a system of agricultural expansion wherein all basic products are to be taken from the soil rather than by synthesis or further development of natural resources. The Farm Chemurgic, which is said to have the sympathy of Henry Ford in principle at least, has as its objective an intense cultivation of the soil and presumably the employment of all employables divided between the farm and industry.

Dr. Hale claims that our national petroleum reserves will be depleted within 20 years unless substitutes are used. He admits that this is contrary to the views expressed by petroleum technologists at the recent Los Angeles convention, as reported in AUTOMOTIVE INDUSTRIES last week. Using farm products, he visualizes the production of alcohol to sell at five to seven cents a gallon, and acetic acid selling at two cents the pound.

However, the biggest prospect seems to lie, according to Doctor Hale, in the development of plastics for use in engineering structures, as for examples, parts of the car—the body and other elements. Ford has invested $5,000,000 in its own soy bean plant for this very purpose, according to the speaker. In fact it was stated that Ford already is working on the production of body parts such as window trim, instrument board, and the like.

The 26 carbon black manufacturing plants in the Panhandle of Texas have a daily production of approximately 385,000 pounds and this will be increased soon to 485,000 pounds by the completion of two new plants by the United Carbon Company.

Cleveland Workers' Delegates See Lewis

(*Continued from page 703*)

of whom are in Washington. There are in addition an indefinite number of the 8400 employees of Fisher Body Cleveland plant in the organization. Of this number 6800 were at one time union members, but after an indecisive strike in Cleveland most of them stopped paying dues.

About 10 other parts shops are represented in the Automobile Workers Industrial Council, also recently formed in Cleveland. The transition from the system of federal unions to an industrial union basis in Cleveland is incomplete and the situation is very vague.

A committee from the Chevrolet union in Toledo sought the aid of Cleveland automotive men two weeks ago in the effort to resist the transfer of gear work from Toledo, but was turned down. Cleveland has several organizations in the M.E.S.A. and other independent unions, but they are not as strong as the A.F.L. group.

Sharply criticizing the A.F.L., Mr. Lewis declared its council had failed to carry out mandates to organize the automotive, steel and other large industries.

Distribution of the program for setting up industrial unions was begun on Tuesday by members of Lewis' staff. Copies were sent to every central labor body, State federation, Federal labor union and internal labor union in the United States.

The committee was formed, an announcement by Mr. Lewis said, "because of the urgency in the basic industries of America." He said its aim is to foster recognition and acceptance of collective bargaining in such basic industries to "bring them under the banner and in affiliation with the American Federation of Labor on industrial organization."

"It is the desire of this committee," Mr. Lewis continued, "to further in every way the efforts of groups of workers in automobile, aluminum, radio and many other mass production industries to find a place within the organized labor movement."

Oct. New Car Financing Dollar Volume Down 19%

The dollar volume of retail financing of new passenger automobiles shows a decrease of one per cent for the month of October as compared with October, 1934, and an increase of 12 per cent compared with October, 1933, according to preliminary estimates made by the Department of Commerce. As compared with September, 1935, there was a decrease of 19 per cent.

The aggregate volume for the first 10 months of this year was 15 per cent above the first 10 months of 1934.

Labor Situation Production Key

(*Continued from page 703*)

part or material. Customers of the strike-involved plant anticipate no curtailment of their operations as a result of the interruption. Having cleared that hurdle, November output should account easily for the earlier projected 350,000 cars and trucks and may surpass that figure by a comfortable margin.

Continuation of the current production rate for the balance of the year would establish an all-time December output record and its attainment appears now to hinge entirely upon the labor situation. The threat of a sympathetic walk-out in other plants still hangs over the industry. At least union leaders threaten to resort to such extremes if they are unable to make progress in settlement of the strike at the Motor Products plant where strikers now are being ignored, a new force recruited and operations resumed.

Available reports on retail deliveries show that new cars are going into customers' hands at undiminished rate. The impetus to sales provided by new models, automobile shows and Christmas buying is expected to maintain demand at a high level for the remainder of the year. The outlook for the first quarter of 1936, however, is not so clear. New factors must be reckoned with as a result of the fall announce-

Motor Exports' 11% Increase Reflects Improving Business Conditions Abroad

	October				Ten Months Ended October			
	1935		1934		1935		1934	
EXPORTS	Number	Value	Number	Value	Number	Value	Number	Value
Motor vehicles, parts and accessories, total value	....	$14,060,959	....	$12,353,102	....	$185,682,620	....	$166,778,074
PASSENGER CARS								
Passenger cars and chassis	7,471	3,836,701	8,040	4,376,409	133,453	74,410,122	127,608	70,291,512
Low price range $850	6,826	3,170,211	7,406	3,703,199	123,512	63,730,512	117,295	58,777,755
Medium price range over $850 to $1,200	462	433,702	391	380,619	7,305	6,923,672	7,023	6,769,022
$1,200 to $2,000	73	111,410	102	154,024	1,055	1,623,244	1,844	2,799,187
Over $2,000	36	88,360	42	98,077	667	1,754,552	597	1,560,526
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	7,109	3,714,767	7,512	3,574,865	80,766	42,036,665	78,510	37,150,186
Under one ton	932	294,606	633	228,437	7,481	2,569,499	7,967	2,603,592
One and up to 1½ tons	4,544	2,133,840	6,120	2,631,414	58,524	26,898,543	61,029	25,625,146
Over 1½ tons to 2½ tons	1,324	937,527	585	481,491	12,268	9,030,860	7,660	6,156,628
Over 2½ tons	279	324,809	138	207,205	2,033	2,150,478	1,518	2,537,690
PARTS, ETC.								
Parts except engines and tires	....	.....	....	.....	....	.....	....	.....
Automobile unit assemblies	....	3,191,411	....	1,933,929	....	38,665,548	....	32,952,638
Automobile parts for replacement (n.e.s.)	....	2,308,927	....	1,824,349	....	21,852,817	....	18,190,192
Automobile accessories (n.e.s.)	....	341,749	....	189,091	....	2,579,263	....	2,160,410
Automobile service appliances	....	428,821	....	169,234	....	3,479,262	....	2,001,598
Airplanes, seaplanes and other aircraft	30	286,042	49	723,259	296	5,848,618	456	7,383,595
Parts of airplanes, except engines and tires	....	447,666	....	642,522	....	4,220,772	....	3,734,205
INTERNAL COMBUSTION ENGINES Stationary & Portable								
Diesel and semi-Diesel	31	136,153	16	12,387	260	729,842	111	241,715
Other stationary and portable	....	.....	....	.....	....	.....	....	.....
Not over 10 hp.	902	61,598	562	36,371	8,190	474,259	4,889	314,873
Over 10 hp.	67	39,244	126	42,742	1,241	704,607	898	529,849
Automobile engines for:								
Motor trucks and buses	1,005	94,576	167	39,891	4,449	570,677	3,673	482,275
Passenger cars	2,834	188,360	177	25,774	22,026	1,421,236	20,299	1,276,365
Engines and aircraft	52	255,076	61	225,800	464	1,944,312	859	3,340,396
Accessories and parts (carburetors)	....	136,125	....	103,257	....	1,338,874	....	1,144,557
IMPORTS								
Automobile and chassis (dutiable)	51	24,690	81	16,486	465	231,103	465	127,266

ments which brought the desired stimulus to new car sales but did nothing to alter the seasonal variations in used car demand.

Current brisk retail activity, therefore, is filling dealers' lots with used vehicles with the result that heavy inventories will have to be carried until spring when the market normally expands. That means a tying-up of capital and an inevitable break on new car sales. If over-allowances have been made, as reports indicate is the tendency, it will mean the elimination of many dealers before spring. There is no concealment by motor officials of the concern felt over this situation.

Sporadic outbreaks of violence during the past week marked developments in the Motor Products' strike which has resolved itself into a three-cornered dispute between the management and two divisions of organized labor.

After unsatisfactory negotiations the management declined to have anything further to do with the striking unions, the Automotive Industrial Workers Association and the Mechanics Educational Society, and on Friday of last week began paying off all employees and taking up badges. Rehiring without discrimination against those who walked out began the following day and by Monday a sufficient force had been recruited to resume operations with one shift. A company official said that 95 per cent of the men either at work or told to come back were employees who walked out. By Tuesday more than half of the plant's quota was back at work and enough more men signed up to complete the force. The management expects normal operations will be restored within a week.

Meanwhile picketing continues and strike leaders report the morale of the men is not broken despite reverses. They contend that few of their union members have returned to work, that many of the company's new recruits are unskilled and charge that a large number of men are being taken on for effect but are being let out through the back door. The A. F. L. local at Motor Products will have no part in the strike since it is opposed to dual unions and was not consulted before the strike was called. Its headquarters were bombed Sunday night and on Monday morning members marched in a body to the plant gates to resume work. The men were required to sign application for re-employment as had non-union members returning to work.

The striking unions were thwarted in their efforts to pull out members in Midland Products plant in a sympathetic strike when the management announced a horizontal wage increase of 5 per cent to 15 per cent for all employees. Strike leaders appealed to the Labor Department at Washington to intercede and have been informed that a conciliator is on his way to Detroit. Unless some action is had before Friday strike leaders have threatened to call out members in eleven plants including both car and parts manufacturers.

Buying Power Recovery Reflected In Medium Priced Car Output Gain

Passenger Car Production by Wholesale Price Classes

(U. S. and Canada)

Ten Months, 1935 and 1934, Compared

	1935	1934	Per Cent Change	Per Cent of Total 1935	Per Cent of Total 1934
$500 and under	1,625,134	1,383,859	+17.5	59.78	65.68
501-$750	977,037	623,077	+57.0	35.93	29.57
751-1,000	81,921	59,931	+36.9	3.01	2.84
1,001-1,500	21,594	24,788	—13.0	.79	1.18
1,501-2,000	7,187	7,434	—3.2	.26	.35
2,001-3,000	4,237	6,035	—29.8	.16	.29
3,001 and over	2,018	1,866	+8.0	.07	.09
Total	2,719,128	2,106,990	+29.0	100.00	100.00

Truck Production by Capacities

(U. S. and Canada)

Ten Months, 1935 and 1934, Compared

	1935	1934	Per Cent Change	Per Cent of Total 1935	Per Cent of Total 1934
1½ tons and less	591,684	482,555	+22.8	93.82	92.54
2 to 3 tons	30,022	31,777	—5.5	4.76	6.09
3½ tons and over	5,170	5,229	—1.0	.82	1.00
Special and buses	3,786	1,915	+97.8	.60	.37
Total	630,662	521,476	+20.8	100.00	100.00

Canadian Trade Treaty Little Aid to Tire Cos.

American tire manufacturers do not stand to benefit materially under the new United States-Canada Reciprocal Trade Agreement, even though it lowers the Canadian tariff on tires by about 14 per cent. United States tire exports to Canada have been negligible for several years for the principal reason that five American companies have established Canadian plants and now control, it is estimated, between 85 to 90 per cent of the total Canadian domestic tire market through these factories. These companies are Goodyear, Goodrich, Firestone, United States Rubber and Seiberling.

The American-owned Canadian tire plants make principally tires of the more popular sizes. The volume of shipments of larger tire sizes to Canada is not sufficient for the 14 per cent tariff reduction to produce any material saving.

W-O Bondholders Get 70% Offer

(*Continued from page* 703)

tee so bondholders may have the net cash price.

Charles G. Cushing, New York, is chairman of the bondholders' committee, and Don M. Kelley, G.M.-P. Murphy Co., secretary. The committee has approved the plan and recommended sale of the bonds by holders.

Arrangement has been made whereby postponement of the payment date may be made, but in no event later than March 1.

Empire Securities, Inc., has also offered to purchase claims of creditors at a price said to be not more than 25 per cent and indicated probably part cash and part stock. C. S. McIntyre, chairman, and J. J. Kendrick, assistant secretary, announce that the creditors' committee has recommended sale of the claims under the proposal. There are about $7,000,000 of claims and approximately $2,000,000 filed have been rejected by receivers.

Mounting delinquent taxes and penalties have been a serious and growing lien ahead of the bonds. At the close of last year taxes amounted to $632,499. One estimate is that total claims, bonds, taxes and other obligations may amount to $16,000,000.

D. R. Wilson, receiver, will complete this week 5400 cars made under the current court order for 10,000 production and it will be about Dec. 15 when finished cars begin coming off the assembly lines again on the remainder of the order.

Judge George P. Hahn in Federal Court has indicated that the mounting taxes and maintenance charges are such that some action must be taken soon to reorganize the company or dispose of the receivership.

In its letter to creditors Empire Securities, Inc., has stated it will, "if it finds itself in position to do so, attempt to effect a reorganization of the company." It is believed that section 77-B of the Federal Bankruptcy Act may be used by Empire Securities, in case it becomes holder of 67 per cent of both claims and bonds.

W. B. Stratton announced a reorganization plan June 26, 1933, which contemplated $1,500,000 of new capital but was unfavorably considered by bondholders at the time.

1936 Canadian Prices On Three GM Cars

Canadian prices for 1936 on Chevrolet, McLaughlin-Buick and Oldsmobile announced at the Toronto and Montreal shows are given in the accompanying tabulation:

CHEVROLET

Standard Series

Coach	$675
Coach with Trunk	705
Special Coach with Trunk	715
Special Sedan with Trunk	800
Sedan Delivery	735

Master DeLuxe Series

Coach with Trunk	825
Special Coach with Trunk	860
Sedan with Trunk	905
Special Sedan with Trunk	945

Commercial

½ Ton Pick-up Delivery	600
½ Ton Standard Panel Delivery	770
¾-1 Ton 10 Foot Panel, 131-in. W.B.	980
1½ Ton 10 Foot Panel, 131-in. W.B.	990
2 Ton Chassis with Cab, 131-in. W.B.	840
2-2½ Ton Maple Leaf Chassis with cab, 141-in. W.B.	990

McLAUGHLIN-BUICK

Series 44; 118-in. W.B.

Coach with Trunk	1,165
De Luxe Coach with Trunk	1,190
Sedan with Trunk	1,240
De Luxe Sedan with Trunk	1,265

Series 46; 122-in. W. B.

De Luxe Coach with Trunk	1,465
De Luxe Sedan with Trunk	1,510

Series 48; 131-in. W.B.

De Luxe Sedan with Trunk	1,760
De Luxe Convertible Phaeton	2,215

Series 49; 138-in. W.B.

6-pass. De Luxe Sedan with Trunk	2,380
8-pass. De Luxe Sedan with Trunk	2,595
8-pass. De Luxe Imperial Sedan with Trunk	2,735

OLDSMOBILE

Six

Coach	980
Coach with Trunk	1,010
De Luxe Coach with Trunk	1,045
Sedan	1,045
Sedan with Trunk	1,075
De Luxe Sedan with Trunk	1,115

Eight

De Luxe Coach with Trunk	1,200
De Luxe Sedan with Trunk	1,280

Pontiac Lowers Prices On Cars in Canada

New reduced prices on Pontiac have been announced by General Motors Products of Canada effective Nov. 22. The representative prices quoted are list prices at Oshawa, Ont. Standard accessories, government tax and freight are additional. The new prices are:

PONTIAC SIX

Coach	$955
Coach with Trunk	985
Sedan	1,005
Sedan with Trunk	1,035
De Luxe Sedan with Trunk	1,075

PONTIAC EIGHT

De Luxe Coach with Trunk	1,085
De Luxe Sedan with Trunk	1,130

Thirty States Change, 15 Reverse Car Plate Colors

License plate colors announced by the American Automobile Association reveal that plates of 30 states and the District of Columbia will have new color combinations. Fifteen states will merely reverse standard color schemes, putting the 1936 text in the color of the 1935 background.

Alabama	Crimson on White
Arizona	Black on Copper
Arkansas	Blue on White
California	Black on Orange
Colorado	White on Blue
Connecticut	Gold on Blue
Delaware	Old Gold on Blue
Dist. of Col.	Black on Yellow
Florida	White on Red
Georgia	Orange on Dk. Blue
Idaho	Black on Orange
Illinois	White on Black
Indiana	Cream on Crimson
Iowa	Blue on White
Kansas	Black on Orange
Kentucky	Aluminum on Black
Louisiana	Blue on Olive
Maine	White on Black
Maryland	White on Black
Massachusetts	White on Maroon
Michigan	Black on Grey
Minnesota	White on Blue
Mississippi	White on Black
Missouri	Black on White
Montana	Black on Rust
Nebraska	Aluminum on Black
Nevada	Silver on Blue
New Hampshire	White on Green
New Jersey	Orange on Black
New Mexico	Taos Blue on White
New York	Orange on Black
North Carolina	Green on Black
North Dakota	Dk. Blue on Dk. Orange
Ohio	Blue on White
Oklahoma	Black on Yellow
Oregon	Black on Aluminum
Pennsylvania	Blue on Yellow
Rhode Island	White on Black
South Carolina	Black on Yellow
South Dakota	White on Maroon
Tennessee	
Texas	Blue on Cream
Utah	Black on Aluminum
Vermont	Blue on White
Virginia	Orange on Dk. Blue
Washington	Blue on White
West Virginia	Yellow on Black
Wisconsin	Green on White
Wyoming	Black on White

Acceleration Tests Urged By Bus Man for Safety

Acceleration tests, similar to brake tests, in connection with safe driving campaigns are advocated by Harry P. Conlon, bus operator in Toledo. Mr. Conlon has been cited for his safety record in transporting 1,250,000 school children during 18 years without an accident.

John Goodman

News comes from England of the death, on Oct. 28, of John Goodman, for many years professor of civil and mechanical engineering at the University of Leeds. Prof. Goodman's name is familiar to many American engineers through his textbook on Mechanics Applied to Engineering, which passed through nine editions.

Walter C. Peterson

Walter C. Peterson died at his home in Detroit Nov. 21. Mr. Peterson was born in Muskegon, Mich., and was 52 years old. He was a graduate of the University of Michigan, and for several years had been chief metallurgist and Detroit representative of the Standard Automotive Parts Co. Mr. Peterson was a member of the S.A.E., the American Society for Metals and the American Society of Testing Materials.

Parmalee Phila. Cab Franchise Bid Lost

Mayor-elect Would Not Approve Sale to Cord Company; Local Man Wins

Philadelphia Rapid Transit Co. directors this week recommended to a special referee the sale of company's taxicab franchise to E. S. Higgins, a Philadelphian. His bid was $298,000. This recommendation practically rules out Parmalee Cab Co. (Cord subsidiary) bid of $302,000.

Recommendation was made on basis of remarks attributed to city's Mayor-elect S. Davis Wilson that he as mayor (after Jan. 1) would not approve sale to Parmalee. A P. R. T. spokesman said Mr. Wilson gave bankruptcies in Parmalee organization; rumors company planned to operate New York cast-off cabs and that an organization familiar with local conditions should operate cab service as his reasons for objecting to Parmalee.

Mr. Higgins, once a vice-president of Parmalee, operated the old Yellow Cab Co. in Philadelphia prior to the transit company's purchase of four cab franchises—Yellow Cab Co. (not connected with Yellow Cab Co. operated by Checker), Quaker City Cab Co., Diamond Cab Co., and Brown & White Co.

The special referee handling the case will report to U. S. Judge George Welsh this week.

Borg-Warner Dividend

Borg-Warner Corp. directors have declared the regular quarterly dividend of $1.75 per share on the preferred stock, and a quarterly dividend of 50 cents per share on the common stock. Both dividends are payable January 2, 1936, to stockholders of record at the close of business December 13, 1935.

CALENDAR OF COMING EVENTS

SHOWS

Kansas City Automobile Show, Nov. 30-Dec. 6

Milwaukee Automobile Show, Nov. 30-Dec. 7

Automotive Service Industries Show—Atlantic City, Dec. 9-13

National Motor Boat Show, New York, Jan. 17-25

CONVENTIONS AND MEETINGS

Overseas Automotive Club, Annual Dinner, Ritz-Carlton Hotel—Atlantic City, Dec. 11

S.A.E. Annual Meeting, Detroit, Jan. 13-17, 1936

American Roadbuilders Assoc., Cleveland, Jan. 20-24

U. S. Chamber of Commerce, Annual Meeting, Washington, April 27-30

JUST AMONG OURSELVES

Story of a "Typical" Automobile Worker

IN its December issue, under the title "Success Story," *Fortune* digs into the life and circumstances of Mr. Gerald Corkum, who happens to be a paint sprayman at the Plymouth plant. Mr. Corkum, incidentally, is president of the Plymouth local of the American Federation of Labor Affiliate. His life and environment are presented as that of a typical American working in the automobile industry.

The article contributes to the understanding of working conditions in Detroit, but is, of course, open to the usual suspicion of whether it represents a "typical" case.

Mr. Corkum is presented as having worked at "nearly a dozen of the plants around town," including Hupmobile, Hudson, Packard, and Chalmers —that last placing him as one of the "old timers" among automobile workers, in spite of his scant 40 years of age.

After working in a variety of unskilled occupations in the automobile industry, Mr. Corkum taught himself the art of spray painting, and became a member of the "Gun Club," spray-painters craft organization at Plymouth. The club later went along into the A. F. of L.

Most of the time Mr. Corkum spends outside his home is spent in the service of the union, or in improving himself through education for such service. He believes that his job is bad for his health, which probably restricts his interest in the work.

His yearly budget, including few items above the grade of necessity, runs a little more than he is sure of making, so it is necessary for Mrs. Corkum to supplement the family budget with occasional work at the Ternstedt hardware plant. He shares many a meal with the family of his brother-in-law, who is on relief. He rides home from work in a car which he and four or five other workmen club together to operate. When he arrives home at night it takes him a half hour or so to relax from the nervous tension which comes from the peculiar trick of operating a spray-gun for even results.

There are a lot of other phases to Mr. Corkum's life, for he is after all a human being, and it has been proved that the full story of a human being cannot be told in even 12 volumes. We recommend to our readers "Success Story," because it is sympathetic, without being hysterical or sentimental.

Additional New-Deal "House Organ" Shows

LIKE most New-Deal agencies, the Consumers' Division of the National Recovery Administration feels the editorial urge. The third issue of *The Consumer* (printed), successor to *Consumer Notes* (mimeographed) is now on our desk. The first article in the issue, "What Basis Tire Prices," demonstrates the continuing interest of the division in the cost of things which affect the use of automobiles. There is no indication, as yet, that that dicta will be forthcoming on the price of complete automobiles, but the N.R.A. study of the industry, being prepared to supplement the Henderson Report may lay the groundwork.

In the matter of automobile-tire prices, the Division is rather inconclusive. It points out that the price of a tire is the price of a variable which must be adjusted for improvements in the quality of tires, and that improvements in highways, etc., must be considered before too much credit is given tire manufacturers for increased mileage.

In 1910 a tire lasted 0.75 years. Present estimates of tire life vary from 2 to 2.5 years, according to the division. Characteristically it points out that mileage improvements due to better highways are the indirect result of government expenditure.

The function of advertising in the tire industry is questioned by the Division on the grounds that the tire industry faces an inelastic market, and cannot justify heavy advertising expenditures, as does the automobile industry, by the contention that advertising to obtain volume results in lower final cost to the consumer. "There are great differences in distribution costs aside from advertising costs," the study points out, and "it frequently happens that a well-advertised tire reaches the public through a very costly distribution channel."

The best basis for determining the relative worth of tires would be a cost-per-mile one, the division believes, but adds that until a scientific basis for such a determinant is worked out, we shall probably have to struggle along with the public's rough and unscientific mental "classification" of what various brands of tires are worth.

The Consumer's Division has provided a Federal organ which reports the news of consumer councils acting in most of the States, and unofficially, for voluntary consumer-protective groups whose number is growing. So far the activity of the division has centered in getting publicity for incomplete studies of the cost-to-consumer of various commodities. If the work continues it is possible that no product of the automotive industry will be free from such investigation. The possibility should be considered. —H. H.

The Horizons of

B. B. Crowe, an AUTOMOTIVE INDUSTRIES reader in San Benito, Tex., who signs himself "cottonpatch economist," is the author of the questions which, in the next few paragraphs, precede Mr. Lawrence's considered reply.—*Editor.*

Can private industry ever again take over even "at a price" the major portion of the present unemployed? I doubt it. Do you of the industrialized sections of this country appreciate fully what has happened in what we might call the frontier sections? Let me give my background. I'm an engineer who started out to be a railroad builder in 1911. Railroad building was substantially over in this country so I went to Mexico and later to Uruguay on what promised to be big projects. Both were abandoned in their initial stages. Is not ten million (the apparently chronic unemployed) about the number heretofore usually engaged in capitalistic expansion in this country?

Undoubtedly a decided and convincing swing to the right on the part of the present National Administration, or more effectively still, its replacement by a really and avowed conservative administration, would restore a lot of wanted confidence, and increase employment. Manufacturers would speed production and increase payrolls. A certain amount of expansion would distribute investor's savings and increase purchasing power. You fellows would have a great time for a while building each other automobiles and electric refrigerators, but if the cotton farmers and railroad builders persisted in keeping their old wooden ice-boxes and in driving worn out "cucarachas" would you not be riding for a fall like that of 1929?

Cotton! Cotton at a price! labor at a price—yes, I've bought it—ditch digging with pick and shovel, ten hours a day for a dollar, in Texas during 1932—and they were glad to get it. I could have got it for less. Do you know what a free market for cotton and labor means? I think I do, yet brother I'm for it. I'm for a free market for everything, are you? I'm eager to see all trade barriers eliminated, and also all immigration restrictions. If anyone in your section mentions "rugged individualism" tell him you know of a fool in Texas who really believes in it.

—B. B. CROWE, C. E. (*Cottonpatch Economist*)

Wanted: A Crystal Globe

A THOUGHTFUL correspondent from the Lone Star State who frankly confesses the taint of conservatism raises certain vital questions. They touch the core of conservative conviction. We believe that thousands of thinking readers who have little patience with the phantasies and fallacies of controlled economics have raised the same questions. We suspect that the answers evolved by most of these readers leave them in the same uncomfortable state of mind as our "Cottonpatch Economist."

Briefly, the point made by our correspondent is that the country has completed its major growth, that the workers employed in capital expansion cannot hope to be reemployed even if industry gets back to normal, that the number engaged in capital expansion in the past is roughly equal to the aggregate unemployed at the present time, that a change in national policies might make some impression on this army of idle but cannot solve the problem of chronic unemployment.

The engineer from Texas concludes with a paragraph which reveals a conflict between his conscience and his cold conviction as an individualist. Rugged individualism with its corollary of complete freedom in economic processes is a ruthless doctrine whose adherents must reconcile themselves to dollar-a-day wages, 5 cent cotton and all that these imply. This latter point we will put on ice and discuss in a later issue.

A Serious Weakness

One of the cardinal weaknesses of the conservative position is a weakness not of intrinsic merit but of demonstration. Our correspondent started out in 1911 as a railroad engineer. With the conceit of after-the-event wisdom we might question his judgment. This would hardly be fair. If we examine the census returns of employment for 1910 we discover very good reason why an ambitious youngster in 1911 elected to become a railroad construction engineer. In that year the steam railroads in the United States gave employment to 1,077,000 workers. In 1900 the number of workers engaged in this field was 580,000. Within a single decade this industry increased the opportunities for employment 85 per cent. Twenty years later, in 1930, total employment was 1,038,000, a decline of 3.8 per cent from the 1910 figure. Standing at the threshold of a career in 1911, railroading seemed to offer rich opportunities. It was not necessary to wait until 1935 to taste the full disappointment of this promise.

Life Cycle of Industry

The particular experience of our correspondent shows how men are forced to reason when they relate their own fortunes to the economic record and attempt to articulate an economic philosophy in terms of personal experience.

The population of the country is still growing. It is 39 per cent greater than it was in 1910. Our railroads have raised their standards of performance and it is highly doubtful if a return of business to normal levels will permit the employment of as many workers as had jobs when the census of 1930 was taken. The observation applies to hundreds of fields, to

Business

by Joseph Stagg Lawrence

cotton cultivation, textile production, highway construction, etc. An industry is born. Jobs are created. It grows and the opportunities for employment mount, at first more rapidly than the population. The industry reaches maturity and stablizes. Improved organization and better equipment reduce the labor requirement per unit. The aggregate employment curve for the industry declines. This is the cycle of industrial life, its infancy, adolescence and maturity. Often a competitor appears and the life of the industry is cut short. Where is the stage coach driver, the horse collar maker, the wood hewer?

Personal Experience

The difficulty with conservatism is that the decline of employment is a clear, poignant fact, an item of vivid, painful experience in the lives of the workers who suffer it. The new opportunities which the ingenuity, energy and restless initiative of men in a free society create can never be summoned as compensation for those who have lost their jobs through progress. The highly skilled glass bottle blower, once a member of labor's aristocracy, now displaced by the machine, gets no solace from the job which has just been filled by an aviation mechanic.

Static Versus Dynamic Economics

The economist has attempted to allay the fears of those who feel as our correspondent does about the future of employment by pointing out that a free economic society is dynamic and not static. The trouble with this explanation is that is is abstract to a fault even though it is *the* answer. If society were static there would be no invention, no new processes, no economies in terms of labor, no new products, no abandonment of old products, no change and no lost jobs. A little thought will reveal the implications of such an order, i.e., that under it there can be no progress. In a static society we could never have developed the automobile, electric power, the radio, motion pictures, the modern bathroom. It is not easy to appreciate what these mean in terms of living standards or—jobs. The automobile industry alone has created more than 5,000,000 jobs. Roughly one out of every eight gainfully employed workers today owes his job to the automobile.

Victims

It is the dynamic quality of our economic structure which creates these new jobs. It is also responsible for the destruction of millions of old jobs. Many of those who lose jobs are innocent, uncompensatable victims on the altar of progress. Their distress constitutes the birth-pain of a new order. It is impossible to insulate individuals against the hazards of change execept insofar as they may be able to do it themselves through thrift and insurance.

We confess that we cannot see which industry during the next ten years will do for the worker what the automobile has done for him during the past generation. We share this myopia with our correspondent. *The fact that we cannot see the form which change will assume during the next generation is not a proof that such a change will not take place or that it will not be as rich in social dividends as the change which has taken place in the past. Our inability to see this change is a limitation in our vision and not a demonstration that society has suddenly become static.* Excessive governmental regulation and onerous taxation may strangle the genius of man and make society stagnant as it did during the Middle Ages. Given reasonable freedom from the atrophying restraints of government we believe that this country can resume its progress and solve its problem of unemployment.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

The upward trend of general business continued last week, and most industrial indices registered gains. Steel operations were close to this year's best level, and production of electricity reached a new all-time high. The colder weather stimulated retail trade, and increases from 2 to 5 per cent above last week's levels were reported. Wholesale business also improved, and many large repeat orders were received in some lines.

Business Activity Rose in October

The Guaranty Trust Company's index of business activity for October stood at the preliminary figure of 76.7, as against 71.6 for the month before and 65.3 for a year ago. The company's index of wholesale commodity prices on November 15 was 55.1, as against 56.7 a month earlier and 50.9 a year earlier.

Car Loadings Lower

Railway freight loadings during the week ended November 16 amounted to 628,330 cars, which marks a decline of 25,195 cars below those in the preceding week, an increase of 43,296 cars above those a year ago, and an increase of 25,622 cars above those two years ago.

Chain Store Sales up 11.7%

Sales of 24 store chains, including two mail order houses, during October showed an increase of 11.7 per cent above those in the corresponding period last year and a rise of about 13 per cent above those in September. Sales of the two mail order houses alone were almost 21 per cent above those a year ago.

Electric Production Again Makes New High

Production of electricity by the electric light and power industry in the United States during the week ended November 16 was 14.6 per cent above that in the corresponding period last year. The current total marks the fourth successive week in which a new high was reported.

Life Insurance Sales Steady

Sales of ordinary life insurance during October were 1 per cent above those in the corresponding period last year. The volume of new business in the first ten months of this year was approximately the same as in the corresponding period in 1934.

Crude Oil Production Rising

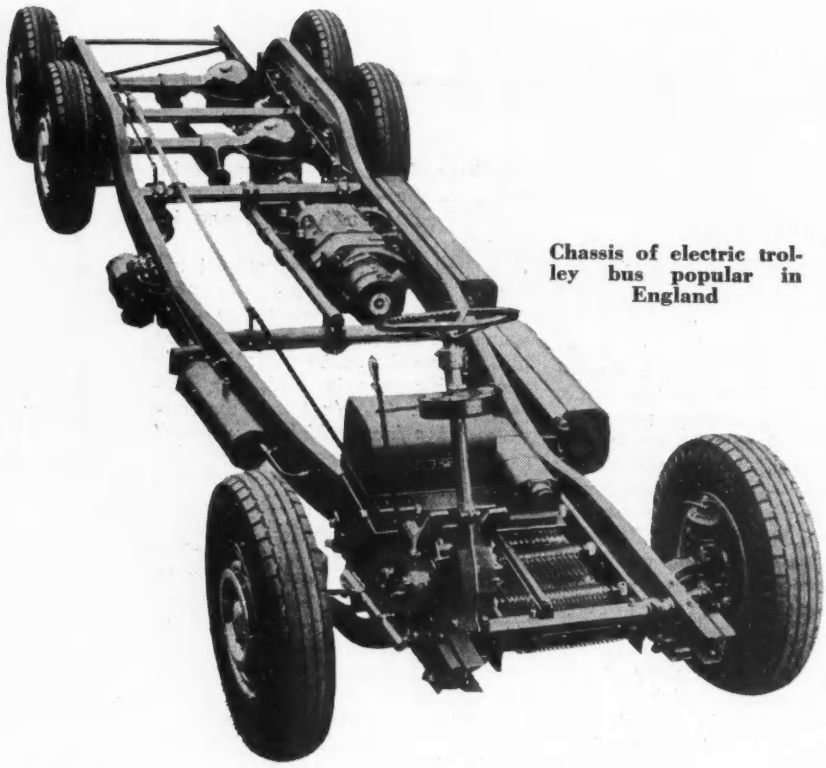
Average daily crude oil production for the week ended November 16 amounted to 2,850,600 barrels, as against 2,802,250 barrels for the preceding week and 2,411,000 barrels for a year ago.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended November 23 stood at 84.3, as against 85.0 for both the week and two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended November 20 showed a decline of $4,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and of government securities remained unchanged. Money in circulation declined $7,000,000, and monetary gold stocks fell by $21,000,000.



Chassis of electric trolley bus popular in England

Better Payload-Chassis For Heavier Trucks Lead

By M. W. Bourdon,
London Correspondent of
AUTOMOTIVE INDUSTRIES

AT the biennial truck show at Olympia, London, still open at the moment of writing, the two outstanding features are the increase of pay-load relative to vehicle weight and the prevalence of the oil engine on buses and trucks with a load capacity exceeding 5 long tons. Prominent among the novel features of design are two automatic transmissions, an axial engine, and automatic brake adjustment.

As regards the increase of pay-load, this has been encouraged by the British system of taxing trucks on the basis of unladen weight. The trend is most marked in vehicles that just fall within the £30 per annum tax class, weighing 2½ tons (5600 lb.) or less, complete with body. At the show of 1931, trucks of this weight were offered by the average manufacturer as suitable for a 2-ton pay-load; at the 1933 show, the average load capacity had increased to 3 tons; at the present show it is as high as 5 tons. In every instance the unladen weight is within 5600 lb., this figure implying a chassis weight of 4300-4400 lb.

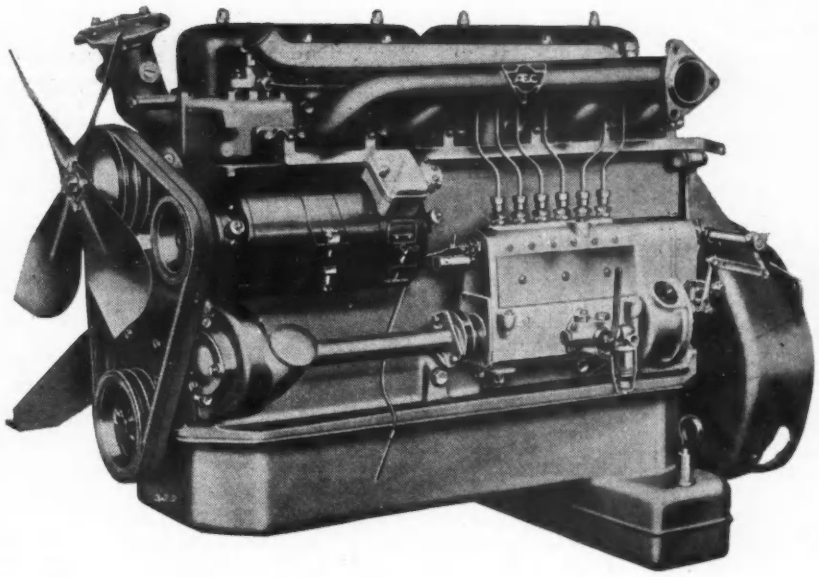
An even greater incentive to manufacturers to keep their trucks within this weight limit is the fact that the speed limit for this class is 30 m.p.h., while trucks of more than 2½ tons unladen weight are not allowed to run at more than 20 m.p.h. The only legal limit on gross weight is the absolute maximum for a four-wheeler, viz., 12 long tons, so that operators of trucks in the "£30-tax, 30-m.p.h., 2½-ton unladen" class can carry 9½ tons of pay-load, if their owners choose to run the risk of breakdown!

It is to be feared, however, that the increase in load rating has resulted in smaller margins of strength and in reduced durability, though it is a fact that British manufacturers, up to quite recently, provided a far larger margin of strength than was needed.

In the heavier types of trucks, four-wheelers and six-wheelers, increased pay-load has been gained by reduction of chassis weight. Thus the four-wheeler of maximum legal laden weight (12 long tons) is now rated to carry 8½ tons of pay-load as compared with 7½ tons at the last show—1933—and 6 tons in 1931; an average reduction in vehicle weight of 1 long ton is implied, therefore, since 1933, following a reduction of 1½ tons between 1931 and 1933. Similarly, the six-wheeler of legal maximum laden weight (19 long tons) now carries 13½ tons, against 10 tons in 1931, representing a reduction of 3½ tons in vehicle weight. Needless to say, these comparative figures are averages; they were compiled by *Commercial Motor* (London) and published in a pre-show issue of that journal.

Eight-wheeled trucks are shown by eight manufacturers; they have four axles, two at the front with linked steering for the four wheels, and two at the rear with four driving wheels. In general, each one corresponds with the same maker's six-wheeler with two-axle drive, plus the additional steering axle. All have oil engines, though three makers—A.E.C., Leyland and Scammell—offer a gasoline engine as an optional power unit. Mercedes and Foden provide an eight-speed transmission, Scammell provides six speeds, A.E.C. and Yorkshire have five, and the others (Leyland, E.R.F. and Armstrong Saurer), four. All have six-cylinder engines except the Scammell, which has a four-cylinder powerplant.

Although at Olympia there are more oil-engined trucks and buses than ever before, and more makers using their own or a stock oil engine, the show produces no notable development in this connection, unless a new Perkins (stock) engine can be so termed. The latter has what its makers term a "threefold" combustion system; this represents a compromise between the air-cell and the direct injection types, for in the throat of the air-cell is a dual-spray injector, one spray being directed into the air-



100 hp. Ricardo Diesel engine powers A.E.C. truck

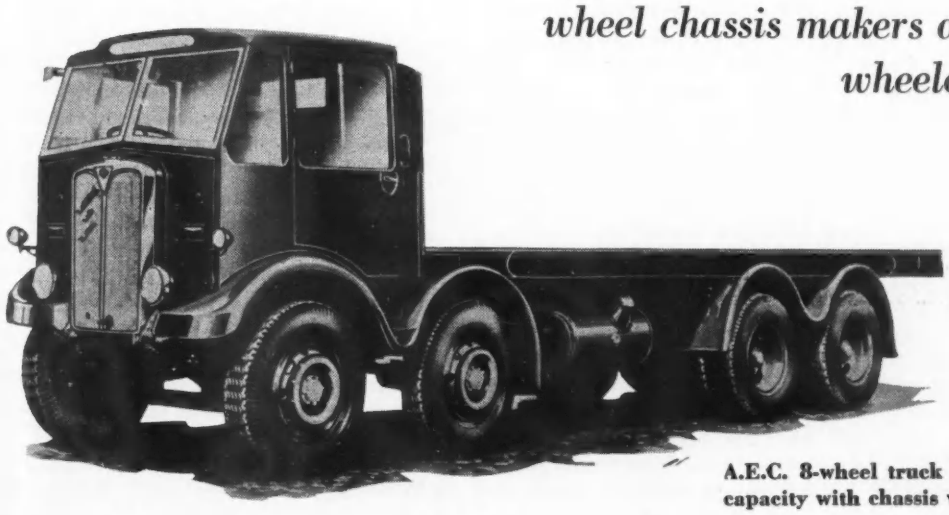
cell and the other into the combustion space above the piston. It is claimed that initial combustion occurs in the cylinder, that slightly later it commences in the air-cell (in which a high degree of turbulence has been set up during the compression stroke), and that subsequently combustion is effective in both spaces. This is the engine that was used by R. J. Munday on Oct. 9 at Brooklands track when he set up world's speed records for oil-engined cars for various distances from the flying kilometer at 94.70 m.p.h. to 100 miles at 88.13 m.p.h. It is said to have a b.m.e.p. of approximately 100 lb., a maximum torque of 157 lb.-ft. and a consumption of 0.39 pt. per b.h.p. hr.

Apart from the Perkins engine, no compromise is evident as between the two chief schools in oil engine design; both are extensively represented, though Leyland, who has been and still is using four-cylinder and six-cylinder 348 and 523-cu. in. oil engines with direct injection into a deep recess at the centre of the piston crown, has now introduced a "light six" engine of the air-cell type. This new engine is used in both truck and bus chassis; it has a bore and stroke of 3½ x 5 in. and develops 71 b.h.p. at the governed speed (2200 r.p.m.), which compares with 85 b.h.p. at 2500 r.p.m. in the case of the gasoline engine of the same bore and stroke, with which it is interchangeable.

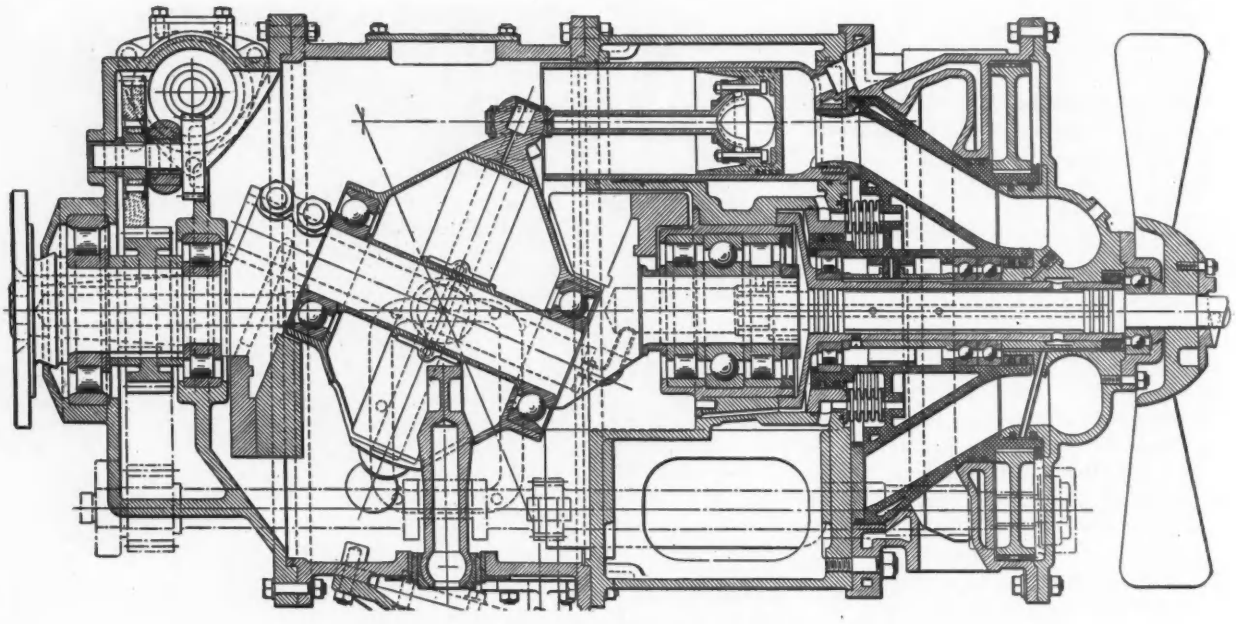
Among the features of the new Leyland oil engine are pushrod-operated

Ratio and Oil Engines Trends at London Show

Automatic transmissions and new axial engine are outstanding novelties; six-wheel chassis makers also showing eight-wheelers



A.E.C. 8-wheel truck has 16 ton payload capacity with chassis weight of 13,500 lb.



Longitudinal section of Bristol 9-cyl. axial engine

valves with screwed-in valve seats, the inlets of mild carbon steel and the exhausts faced with stellite; a nickel-steel crankshaft with seven bearings, 2½-in. crank pins and a vibration damper; connecting rods of H section drilled for pressure lubrication of the floating piston pin; big-end bearings composed of an aluminum-alloy top half and a white-metal bottom half; pistons of heat-treated aluminum alloy with four compression and two scraper rings, and cylinders and crankcase an integral iron casting. The fuel pump is a C.A.V.-Bosch with fixed timing, and the engine as a whole is rubber mounted in the chassis.

The majority of British oil engines have inserted cylinder liners (a practice that is extending in gasoline engines for trucks and buses), and there are more "wet" liners than "dry"; but there is no uniformity in regard to liner material, though case-hardened centrifugally-cast liners are widely favored. Weight reduction has been effected in a few cases by the use of magnesium alloy in place of aluminum for the crankcase. A.E.C. uses lead bronze for the big-end bearings. Two valves per cylinder are normal, but Armstrong Saurer has four. Compression pressures vary extensively, apart from the differences due to the type of combustion chamber (air-cell or direct injection); Crossley uses the highest, 20 to 1, in an engine with the Ricardo Comet (air-cell) head and Gardner with direct injection the lowest, 13 to 1. Gardner engines are used by several prominent chassis manufacturers and are made with 3, 4, 5 and 6 cylinders, all with the same bore and stroke; the five-cylinder type is frequently preferred in lieu of the six, for it can be used without structural variation in the chassis in place of a six-cylinder gasoline engine where the six-cylinder oil engine would be too long. Daimler, for example, uses it for single-deck buses and the six-cylinder for the double-deck chassis.

Although the oil engine has made a lot of headway since the 1933 show at Olympia, its chief use is still in heavy trucks for long-distance services and for buses. It still costs initially considerably more than the corresponding gasoline engine, as much as £200 in some cases, and this is one reason why it is not often used except where big annual mileages are the rule. Karrier, Commer and Leyland offer an oil engine as an option on chassis for a 3-ton payload, but on the whole the gasoline engine is still standard practice for all sizes of less than 6-ton capacity. The smallest British oil engine yet produced is shown at Olympia by its makers, the Victor Engine Company; this is a horizontally opposed two-cylinder of 67 cu. in. piston displacement, intended for light delivery vans, but it has not yet been standardized by any manufacturer of the latter.

No Chassis Novelties

Apart from new models for special purposes, the show presents no striking novelty in chassis design, though the three-wheeled tractor shown by two firms at Olympia in 1933, and known as the "mechanical horse," is now produced by other manufacturers and is gaining in popularity for local hauls, particularly for use in railroad yards and on docks; the railroad companies are extensive users of this type of tractor, which, hauling four-wheel or two-wheel trailers with loads up to 3 tons, gives the outfit a turning circle no greater than its length. A four-cylinder gasoline engine of about 10 hp. is the normal powerplant.

As indicated above, the show contains two new automatic transmission systems. Both have been adopted as optional to the normal type, one by Maudslay and the other by Crossley. The Maudslay is the conception of an Australian engineer, Hobbs, and consists of a single planetary train, of which the planet pinions are integral with eccentrically loaded shafts, the "bobweights" thus implied serving to impose a braking effect increasing with the speed; thus an infinite variety of ratios is secured from zero to direct drive. Owing, however, to the fact that as the bobweights move outward from the axis of the gear a negative torque is produced, there is need for a roller (free-wheel) clutch and a torsion shaft to obviate what is termed a "vibrational beat effect." A peculiar and unexpected feature of this transmission in practice is that when the vehicle attains to a speed of, say, 15-20 m.p.h. after a gradual decrease of ratio has been afforded automatically, momentary release and depression of the accelerator pedal causes a direct drive to be gained earlier than would normally be the case. Similarly, if the accelerator be only partially released and then depressed to the full, a ratio somewhat lower than direct drive is obtained.

In the new Crossley transmission, also, planetary gears are used. But in this

case there are four definite ratios, three indirect and one direct. The indirect ratios are gained from a series of planetary reduction gears of small ratio; on low gear all three trains are used, on second gear two of them, and on third only one. This result is effected by centrifugal means in conjunction with plate clutches and ratchet gear, by means of which the transmission ratio is varied automatically, stage by stage, to suit maximum load conditions relative to engine speed.

Converter with Transmission

In combination with this transmission, what is termed a "flexible running disk converter" is used. In effect it is an automatic centrifugally operated clutch, but instead of there being driving and driven plates on the same axis, there are driving rings interleaved with three series of disks free to rotate about their axes and so located as to cause only crescent-shaped contacts to be made between the rings and the disks. The latter are mounted on spindles projecting from a three-armed carrier member secured to the driven shaft, and as engine speed increases, bobweights cause the disks to be progressively clamped between the rings. Light pressure causes the disks to rotate freely on their centers, the carrier remaining stationary; as pressure increases with increase of engine speed, the disks tend to rotate bodily with the rings, as well as about their own centers, causing the carrier and driven shaft also to rotate as the load resistance is overcome. Finally the rings and disks are "locked" together, the disks gradually ceasing to rotate about their centers and rotating bodily at the same speed as the rings. Rings and disks have metal-to-metal contact and run in an oil bath.

As an optional transmission, Leyland is offering, in improved form, the Lysholm-Smith hydraulic torque converter introduced at the 1933 show. Over a score of municipal and private bus undertakings have been using this system during the past year or two, and that it has proved successful in service is evidenced by the number of repeat orders given. It embodies an engine-driven oil pump delivering to a three-stage turbine, the oil passing through a cooler on its way back to the pump. The system includes a free-wheel on the driven shaft and a two-way hand-operated friction clutch, these allowing the turbine to idle when the clutch is moved to disengage it and engage a direct drive from engine to propeller shaft. The fluid used is a mixture of kerosene and lubricating oil.

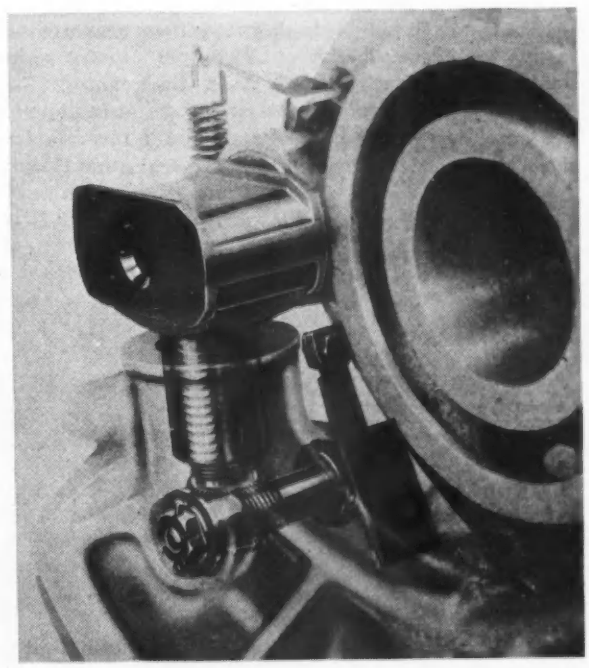
The automatic brake adjustment previously mentioned has been standardized for Daimler buses after a long period of tests by various bus operators. There is a separate adjuster with each brake. The shoes are of aluminum, and in the nose of the lower one the steel wearing plate (with which the cam makes contact) has a cylindrical extension with a square thread in its bore. Screwed into the latter is a solid abutment piece, which bears upon the bottom of the hole in the nose of the shoe and has worm teeth formed around its lower end. Engaging with the worm teeth is a worm on a short transverse shaft with bearings in the shoe, the end of the shaft having a ratchet wheel engaging a spring-loaded ratchet secured to the axle casing. Thus, when the shoe moves beyond the normal limit in brake application and is later released, the ratchet engages a fresh tooth on the wheel and slightly rotates the worm. This motion is conveyed to the abutment piece, giving it rotational movement that causes the cylindrical extension of the wearing piece to be lifted a shade farther out of the shoe. There is no pressure on the worm gear arising from brake application, only on and through the square threads of the wearing plate and abutment piece. Apart from the nose of the bottom shoe and the adjusting device it houses, the whole of the brake rigging, including the cam, is unaffected in design or dimensions.

The only novelty in engines at Olympia is the axial engine introduced by the makers of Bristol buses, who also are owners and operators of a big fleet of buses running in the West of England. This engine is of the wobble-plate type, differing from the swashplate engine in that the member which transmits power from the pistons to the crankshaft does not rotate. Around the front end of the crankshaft are nine equally spaced, horizontal cylinders with their pistons coupled to the wobble-plate by connecting rods having spherical bearings at each end—in the pistons and on ball projections of the wabble-plate. The latter, with a torque member or stabilizer to hold it stationary, is mounted on ball bearings on the inclined pin of the single-throw N-shaped crankshaft. The crankpin is set at an angle of 22½ deg. to the axis of the shaft. Power impulses from successive cylinders cause the wabble-plate to oscillate, thereby imparting rotational movement to the crankshaft.

Owing to the disposition of its cylinders the axial engine lends itself to the use of a rotary valve system; a single rotating member has four pairs of inlet and exhaust ports registering alternately with a single port in each cylinder head. The valve member rotates at only one-eighth engine speed, and a seal between cylinder heads and valve face is gained by the cylinder block carrying nine segments (forming a complete circular path, with ports) which in turn are pressed against the valve by pressure within the cylinders. Two carburetors in series are used, feeding each end of a single horseshoe-shaped duct.

This engine is offered as an option, the alternative being a six-cylinder engine on orthodox lines. The axial engine is of 427-cu. in. capacity and develops 150 b.h.p. at 3000 r.p.m.; the six-cylinder engine (443 cu. in.) develops 110 b.h.p. at 2400 r.p.m. and weighs 8 lb. per b.h.p., compared with 5 lb. per

(*Turn to page 734, please*)



Automatic brake adjuster used on Daimler buses

Fuel Testing, Diesel Costs Dominate A

Operating costs of automotive equipment was the central theme of both the A.P.I. meeting in Los Angeles and the regional meeting of the S.A.E. in San Francisco, A. Ludlow Clayden reports in his final article. This is in contrast with previous meetings where increased power and performance were the chief subjects.

LOOKING back over the West Coast meetings of the American Petroleum Institute[1] and the Society of Automotive Engineers,[2] remembering the papers and more particularly the discussions, the most striking thing is the concentration of thought upon the cost of operating automotive equipment. This was not due to a deliberate effort on the part of either body, and yet the two groups of papers form almost an operating cost symposium. The report of the A.P.I. automotive survey committee, which was based entirely upon the economics of the situation as seen by the refiner, appeals to the automobile manufacturer to help keep down the cost of fuels and lubricants by not too rapidly changing the requirements of cars. The several papers on Diesel operation voice the desire of truck fleet owners to reduce haulage costs. The papers on the use of liquefied gases —butane—have as their keynote the money saving possible from the proper application of such fuels. Even the A.P.I. session on polymerization product gasolines, while it may seem outside this general characterization, does really fit right into the picture, because the only object of this new type of process is to make very high octane gasoline as cheaply as possible in response to the demand coming from aviation.

This concentration upon cost is peculiarly interesting, because in the past papers of both bodies have tended to concentrate upon developments to increase power or performance of automotive machines. It is perhaps still more striking when it is remembered that both industries are feeling much easier in their minds about the future than has been the case for several years. For the sake of still further expanding the automotive market this interest in operating cost is welcome.

Turning away from this phase to some degree, a particularly interesting group of papers were the two on improved lubricants given the A.P.I.[3] and G. L. Neely's paper on extreme pressure lubricants at the S.A.E. Of course, oiliness or film strength of lubricants, if it really exists, does have as its major objective the reduction in rate of wear and so is a cost-of-operation subject too.

The A.P.I. papers were somewhat severely criticised in discussion. The first, on the fundamental theory of lubrication, was attacked from its experimental angle because the molecular orientation "regimentation" shown was determined for still and unloaded films, and the discussers thought it extremely improbable that moving or loaded films would behave in the same manner. References were made to a variety of other theoretical and experimental data which run contrary to the author's conclusions. The second paper, dealing mainly with laboratory and road tests of oils with and without oiliness addition agents, was criticised mainly because the amounts of wear reported are so microscopic. It has been universal experience that wear under arduous operating conditions is much less than it is in normal service, and that attempts to make tests under conditions of "normal" service are

[1] Los Angeles, Nov. 11-14. See AUTOMOTIVE INDUSTRIES, Nov. 16, p. 641.

[2] San Francisco, Nov. 18-19. See AUTOMOTIVE INDUSTRIES, Nov. 23, p. 674.

[3] See AUTOMOTIVE INDUSTRIES, Nov. 16, p. 658.

Looking at the 1400-foot gap in span to be bridged without a float.

API-SAE Coast Meetings

By A. Ludlow Clayden
Special Correspondent for
AUTOMOTIVE INDUSTRIES

Group photographed outside Caterpillar plant at San Leandro, Calif.

abortive because of the tremendous variations in results obtained with the same articles of test—machines, fuels or lubricants.

However, the gist of the A.P.I. paper discussion was really found in G. L. Neely's S.A.E. paper. This discussed tests made on different compounded lubricants on different machines, particularly the Almen and Timken machines and a special machine using actual worm gears. This tool was designed and built in the Standard Oil Co. laboratory at Richmond, Cal., and some 7,000 tests have been made with it. Mr. Neely concludes that whether an addition agent is good or bad can only be decided after a great variety of tests, and even then, not with any too great confidence. He showed how changing speed or temperature could affect frictional loss, extreme pressure effect, rate of wear and durability of lubricants, to an extent so great as to throw some compounds from one end of the scale to the other; and that the results obtained under one set of conditions could flatly contradict results got by another set. Of course, neither Mr. Neely nor the other discussers of the subject voiced any disbelief in the reality of oiliness, they merely emphasized the immense difficulty of the subject. The discussion provided no real conclusion but amounted to saying that some addition agents are apparently advantageous under some conditions; they may or may not be harmful under others, and only long time experience will ever decide whether any of them are of real value in engine oils.

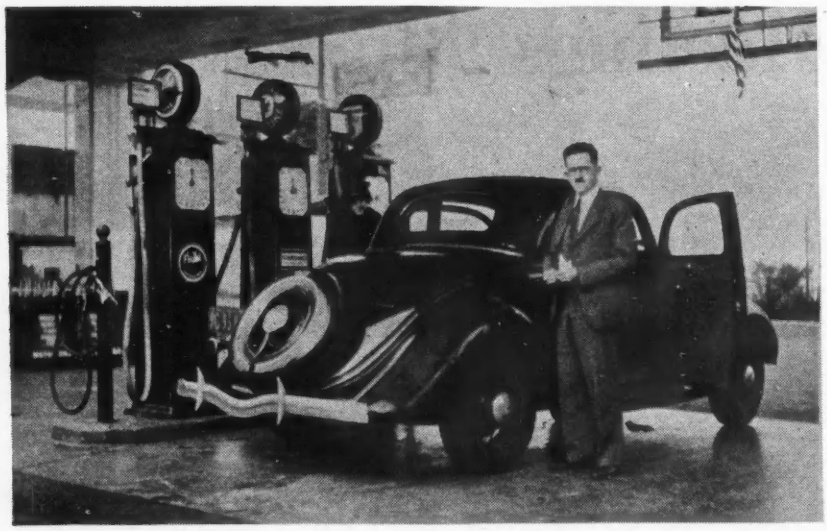
On the strictly "extreme pressure" side of the subject there is of course no doubt as to the reality of this effect. However Neely pointed out that even here the fact that an oil had high e.p. effect did not mean it was a good lubricant. Frictional resistance must also be considered and also rate of wear. Curiously enough his data show that low friction and low wear do not necessarily go together, and neither has necessarily any connection with e.p. effect. There has to be considered also the durability of the oil and the effect of temperature upon its action.

In connection with testing for wear Mr. Neely has used the Timken machine extensively and has found one very curious effect. If the machine is mounted so that it is subject to slight vibration, the rate of wear can be enormously different from what it is with a rigid mounting. If the lever of the machine is left floating, as it normally is for wear testing, the wear will probably be much higher than if the lever is locked during the run. Mr. Neely therefore feels that while a fine job apparently has been done in designing the S.A.E. e.p. testing machine, it is now necessary to develop friction and wear testing procedures either for the same machine or by designing some new testing tools.

Summing up, the conclusion reached is that in either motor oil oiliness or e.p. lubricant fields it is extremely difficult not to play "hunches." Almost anything can be proved about almost any compounded product by selection of method of test and it is likely to be many years before the subject is clarified to a point where we can be really sure of our conclusions. Meanwhile intensive research is in progress and will continue in many laboratories.

Turning now to the second subject jointly considered by the two meetings, that of butane mixtures as automotive fuels, Prof. Carl J. Vogt's paper showed the possibilities from power and economy viewpoints under ideal conditions while P. W. Ensign's S.A.E. paper dealt with practical details and the making of conversions under conditions far from ideal. The fuels actually used in California and in other parts of the Coast vary from almost pure butane to mixtures down to half butane and half propane. Their use began because such mixtures were very cheap compared with gasoline and were tax free.

However present development is progressing, not for these reasons, but because liquefied gas fuels have shown themselves very desirable even when all cost advantage is eliminated. Ensign said that the consumption of the fuels west of the Rockies this year will be at least 8,000,000 gal. for purely automotive service, mostly trucking with some bus operation. Mileage on good conversion jobs is apparently about the same as gasoline mileage



Jack MacGregor fills up with his own gasoline.

despite the lower energy content per gallon. This is because very much nearer theoretically ideal mixture ratios can be used without sacrifice of performance and because the distribution of a perfectly dry gas through the manifold is nearly perfect while that of a relatively wet gasoline mixture cannot be.

One of the most interesting parts of Mr. Ensign's paper which was supported in its entirety by G. L. Holzapfel, dealt with the main difficulties in making conversions. For example, it is recognized that but few, if indeed any, standard truck engines can be altered to have a compression ratio really suitable for the fuels. Practically the limit for compression raising is often not determined by the combustion chamber design but by the inability of stock starting motors to turn over with much increased compression. Again, if compression is raised to the limit possible and starting is not a problem, then ignition systems may fail, due to insufficient voltage, a condition which in the case of magnetos is rather expensive to correct. Finally, plug life may be shortened excessively. All of which means that lacking engines designed and built for butane the full possibilities of this fuel cannot be realized.

Heat on manifolds is also a severe conversion problem. Butane should have a cold manifold of larger cross section than required for gasoline, thus increasing volumetric efficiency. This can but seldom be arranged in making conversions. Because butane can be used with lean mixtures, performance of the engine becomes more sensitive to accurate spark timing in proportion to throttle opening. So apparently the first steps to be taken by a truck manufacturer willing to offer a butane fuel design would be to raise compression to perhaps seven to one, arrange to keep all heat possible away from an enlarged intake manifold, and strengthen up the ignition and starting characteristics of the electrical system. Incidentally a large fleet of Mack trucks is now in process of delivery for use on a dam-building project in Southern California in which these matters have been given attention. This is probably the first fleet really arranged to work on butane in a proper engineering manner and its performance will be watched with the greatest interest.

While this butane development has been in progress other California operators have been experimenting with Diesel engines on a quite large scale. C. G. Anthony presented to both A.P.I.[4] and S.A.E. almost identical papers describing his experience with Diesels used on large truck trailer combinations in operation of the Pacific Freight Lines. He reported an apparently very thorough cost record of 20 otherwise identical trucks in similar service, 10 having gasoline and 10 Diesel engines. Records were kept for the first four months of 1934 and again for the same months of 1935. They show an enormous saving in fuel cost in favor of the Diesel, but an extremely large part thereof due to the absence of a tax. The consumption was lower, about 60 per cent of gasoline consumption, so that even had fuel prices been the same there would have remained a substantial net saving on fuel expense. Against this, however, practically all other costs were higher for the Diesel fleet. Higher first cost gave higher fixed charges, these being based upon 200,000 miles as the economic life of either truck. Lubricating oil consumption was greater with the Diesels and repair costs much higher. However, this is undoubtedly largely due to the higher cost of replacement parts, which is also partly due to the gasoline engines being products of large-scale manufacture, the reverse being true of the Diesels.

The automotive Diesel today is developing mainly by virtue of the present low price of fuel. Taxation and distribution charges will swiftly raise the price to at least equal that of gasoline, and thereafter the Diesel must justify itself by its inherent fuel economy possibilities. It therefore behooves the Diesel engine builders to make hay while the sun shines, to try to discover how to use cracked fuels of low cetene number, of which the potential supply is unlimited. At least for a few years to come it looks as though the struggle in California would be between butane and Diesel, and between both of these and gasoline. A resident east of the Rockies can hardly believe the extent

[4] See AUTOMOTIVE INDUSTRIES, Nov. 16, p. 657.

A. G. Marshall and C. B. Veal talk it over outside the Caterpillar plant.

to which the Coast is already using both new types. It is a country of long hauls and heavy loads over roads of all kinds and, let it not be forgotten, with a very wide temperature range, some of the hottest and also some of the coldest territory in the United States being served by these coastal haulers. Truck engineers should watch what is going on very closely, for the amount of data being collected is prodigious.

S. B. Shaw, in talking to the S.A.E. on problems of Pacific Coast fleet operation, stated that the worst fuel problem was vapor lock, which manifested itself especially in the spring. Of course, this is aggravated in his territory by frequent high altitude operation. Another principal engine trouble he has found to be ring sticking, which is reduced by using lighter oils. In finds, is liable to cause severe foaming, a fact well known to the oil industry. In the discussion it transpired that one of the largest fleet operators here, or in fact anywhere, still uses straight castor oil for all worm drive trucks.

There was one A.P.I. paper of real importance to which only passing reference can be made, this being Doctor Brown's on the advantage of high volatility gasolines. This paper was not available in manuscript but will be published in A.P.I. proceedings. It described an elaborate series of tests on a single car of popular make with fuels of a wide range of volatility. The conclusions were that on all aspects of performance and mileage, the best results were obtainable from fuels of very high volatility when moderate engine adjustment changes were made to suit the various gasolines. As was pointed out in the report of the automotive survey committee, the oil industry is ready and anxious to improve fuel volatility and Doctor Brown's work shows that improved performance will result if only automobile manufacturers will make the small changes necessary to permit the marketing of highly volatile fuels.

Perhaps one of the most interesting sessions was that devoted by the S.A.E. to testing procedure. T. B. Rendel described Diesel fuel testing by the several known methods, of which the most promising at present appears to be that using the modified C.F.R. engine as developed by the volunteer group on C. I. engine fuels. This paper was not discussed, so few having had experience with the method, and the paper was mainly intended to acquaint the Pacific Coast group with what was being done.

Quite different was the paper by C. F. Becker on gasoline knock testing because this was designed to provoke discussion of the special problems encountered in Coast laboratories. California sells large quantities of gasoline for shipment to other territories and most of this is purchased on specifications involving octane number. Hence accuracy of determination is extremely important. Becker stated that accuracy in this test could make a difference in the value of 50,000 bbl. of gasoline as great as $6,000.

Much of the trouble in obtaining check tests between laboratories was laid to the bouncing pin. Clark of the Shell Oil Co. showed a modified pin of which both ends were pointed, the points being just slightly rounded off. The diaphragm is put in a press which makes a small indentation in the center and the contact blade is provided with a cap beneath it recessed to take the upper pointed end of the pin. This centers the pin without allowing it to touch the barrel, and so, he claims, makes its bouncing more free and less susceptible to occasional frictional errors.

Altogether the S.A.E. meeting was of extremely high quality. The papers dealt with practical every-day problems of operation, but not problems of performance or of design novelty which so much more frequently engage the attention of automobile engineers. The California members take their S.A.E. seriously and the meetings were very reminiscent of the good old days when we had boat trips for summer meetings, and discussers had unlimited time and told what they believed to be the truth without fear or favor.

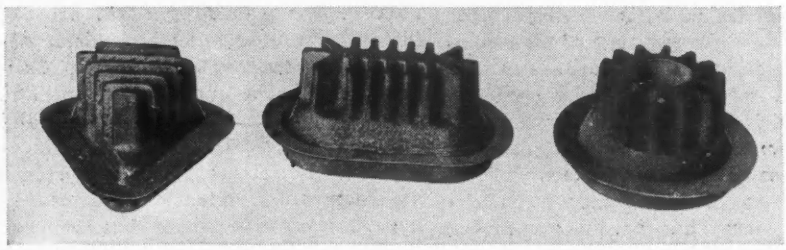
In many ways this Western country is the main proving ground for automobile products. Problems that exist elsewhere exist here in intensified form and there are besides some problems peculiar to this territory. The industry can well afford to pay attention to what the California sections can tell it.

High spots of the meeting were, of course, the visit to the Caterpillar Tractor plant and the one to inspect the building of the gigantic San Francisco-Oakland bridge. The Caterpillar Co. was host to over 200, who were split into four groups and given four separate inspection tours. C. G. A. Rosen described the injection system used on Caterpillar Diesels and stressed

(*Turn to page* 734, *please*)

C. B. Veal, Dr. O. C. Bridgeman, A. L. Foster and R. R. Matthews pass the time while waiting for the tug to Yerba Buena Island, during inspection trip covering San Francisco-Oakland Bridge.

Iron and Copper Bonded in



by Irving E. Aske
Campbell, Wyant & Cannon Foundry Co.

Fig. 1—Three designs of copper inserts developed to fit three different combustion chamber designs.

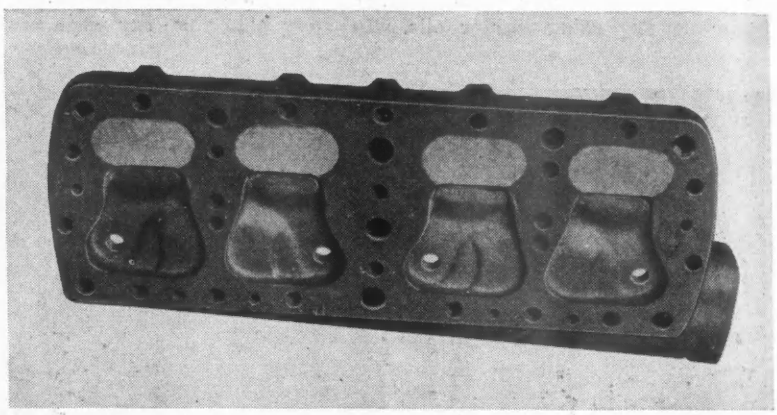


Fig. 2—Locations of copper inserts in cylinder head are shown in this illustration

UP to a few years ago, cast iron was almost universally used for both engine cylinder blocks and heads, but as compression ratios were carried higher with each succeeding model, the need for higher heat conductivity in the head was increasingly felt. Higher conductivity permits of using higher compression ratios for a certain combustion "ping" or detonation. Where the higher conductivity is of particular benefit is in that part of the cylinder head between which and the piston there is only a small clearance when the piston is at the top end of the stroke, this narrow space having great influence on the tendency to detonation. It is important that the surface over this narrow clearance space be kept as cool as possible, so that it may have the maximum cooling effect on that portion of the charge which burns last.

While a head made entirely of a metal with high heat conductivity accomplishes the object of cooling that portion of the combustible charge last to burn, it also cools all the rest of the charge, for it covers the whole combustion chamber. To compensate for the higher heat losses resulting from the greater conductivity of the entire head, the combustion time must be reduced, and this tends toward roughness of combustion. The iron cylinder head was ideal from the standpoint of smoothness of combustion, because its low conductivity makes the increased heat loss a negligible factor, but its tendency to cause detonation placed a low limit upon the compression ratio permissible with it.

The solution of the problem would seem to be to make that part of the cylinder head which is in contact with the last portion of the charge to burn, of a material of high heat conductivity, and the remainder of the head of a low-conductivity material. Such a choice of materials, in conjunction with a volume distribution in the cylinder head which will not compromise smoothness, will give all the benefits of high compression without the detriment of harshness in operation.

The problem confronting engine designers and iron founders then would seem to consist in greatly increasing the thermal conductivity of that portion of the cylinder head in close proximity to the piston at the end of the stroke and maintaining the low conductivity of cast iron over the remainder of the combustion chamber.

If cast iron can be bonded to other metals having much higher heat conductivities, then the cylinder head may be made of two unlike metals bonded together, giving much the same effect as an alloy with one component segregated. Each metal will retain its physical characteristics, that is, its heat conductivity, heat expansion, tensile strength, and resistance to corrosion.

Copper has approximately twice the heat conductivity of any other available metal suitable for the purpose. It has a relatively high resistance to corrosion, a relatively low coefficient of heat expansion (more nearly equal to that of iron), and a relatively high melting point. It can be alloyed with cast iron and bonded to it securely. It is easily machined and cast, and its cost, per unit of volume, is just about the same. Iron and copper make an ideal combination for a cylinder head, the iron limiting the heat losses to the jacket over the major portion of the combustion chamber, and the copper limiting the temperature rise of that part of the charge which burns last, excessive heating of which is ordinarily the cause of "pinging." It has been found that the cooling surface of the copper in contact with the jacket water must be at least three times that of

Composite Cylinder Heads

Former limits heat losses, latter temperature rise; Casting of two metals involves many new problems in foundry technique — have widely different pouring and solidifying temperatures

the surface exposed to the combustible gases, as rapid heat transfer over this surface is essential to proper detonation control.

Casting a cylinder head of iron and copper involved many new problems in foundry technique, as the two metals have widely different pouring and solidifying temperatures. The copper has a strong tendency to melt before the iron has set, and the molten iron is likely to chill severely on coming in contact with the cool copper. These problems were successfully solved in our foundry, however, by making the cylinder-head castings of special iron, under temperature control, in the following manner:

A green sand mold is prepared in the usual manner, and inserts of cast copper of the desired size and form are laid into the mold, one for each combustion chamber, projecting ¾ in. into the water jacket. A flange approximately ¼ in. wide surrounds the copper insert, and when the molten iron is poured into the mold this becomes bonded with the iron. Proper gating, good metal distribution, and proper pouring temperatures are essential if the copper is to be prevented from melting and the iron from chilling during the processes of pouring and solidification. After the casting with its copper insert has been made, the head is sand-blasted and then tested under a water pressure of 100 lb. per sq. in., to make certain that it is water-tight. It is then ready for machining.

To demonstrate the perfect bond between the copper inserts and the iron, an iron-copper head was placed in an oven and raised to 1400 deg. F. It was then removed and allowed to cool to room temperature. After numerous repetitions of the heating-and-cooling process, the casting was tested under 100 lb. per sq. in. water pressure and found to be water-tight. Such a test is calculated to produce stresses at the bonded surfaces many times more severe than those occurring in engine operation under conditions of full load and desert heat.

To produce the maximum cooling effect on that portion of the charge last to burn, the copper insert must have both a large area in contact with these gases and a large area in contact with the jacket water. Assuming that the cooling water can circulate freely around the cooling-fin surface, the rate

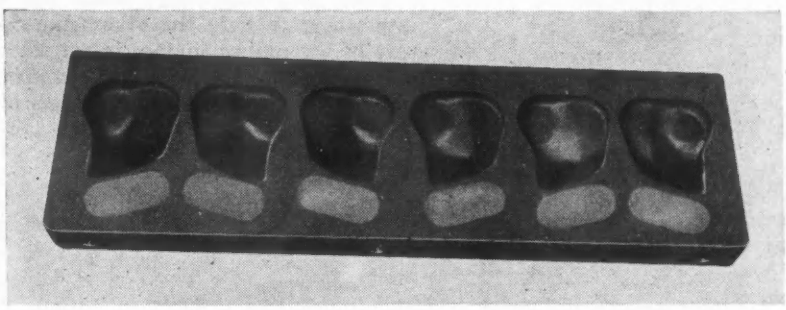


Fig. 3—Another view showing locations of copper inserts in cylinder head

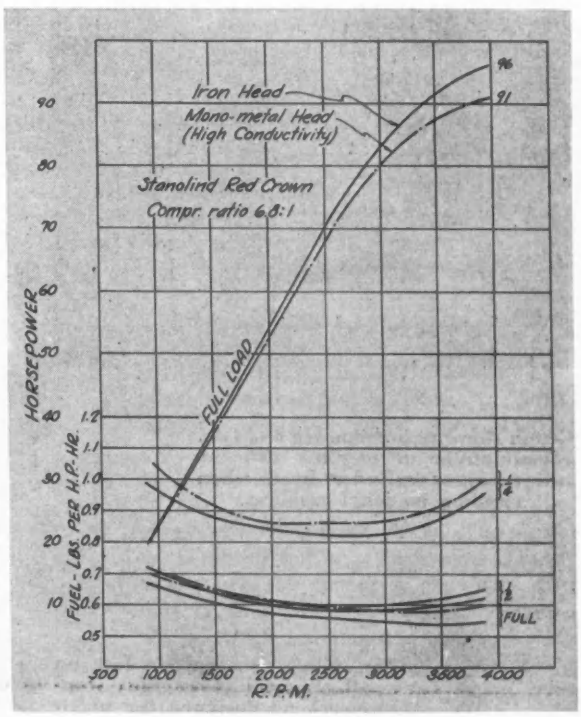


Fig. 4 — Graph showing horsepower output and specific fuel consumption of engines having complete head of high heat - conductivity metal and of cast iron with copper insert, respectively

at which heat is given up to it will be in direct proportion to the cooling surface. Experimentation has shown us that if the temperature of the heating surface of the insert is to be kept fairly close to that of the jacket water, the cooling surface must be at least three times as large as the heating surface. Fig. 1 shows three different designs of copper inserts, developed to fit three designs of combustion chamber. Figs. 2 and 3 illustrate the locations of the copper inserts in the cylinder heads. The finned portion projecting into the water jacket is ¾ in. high, while the solid portion of the insert has a diameter of 2 in. The designs range in weight from ¾ to 1½ lb., depending on the cylinder bore and the type of chamber used. The metal is practically pure copper containing only a small proportion of a deoxidizing agent that is added to produce sound castings. It has a thermal conductivity equal to 60 per cent that of pure copper and a melting point of 1960 deg. F. Great care is exercised to maintain the purity during the melting process, as only small proportions of arsenic, phosphorus or iron reduce the heat conductivity of the metal very materially.

The water passages from the cylinder block to the cylinder head should be located as close to the copper inserts as possible, to produce the best cooling effects on the inserts. The more rapid the circulation around the inserts, the more rapid the heating transfer and the more effective the cooling of the gas last to burn. It is also advisable to use as large a mass of copper as possible, so that the metal may serve as an effective heat reservoir during the period the gas burns in the clearance. The shape of the inserts, of course, can be varied to fit any particular design of cylinder head.

The cooling capacity of the inserts may be expressed by the product of the weight of the insert, the specific heat of the metal, and the conductivity of the metal. Comparing, on a volumetric basis, two metals available for insert purposes, copper has an absorption factor of

$$0.092 \times 8.93 \times 0.60 = 0.493$$

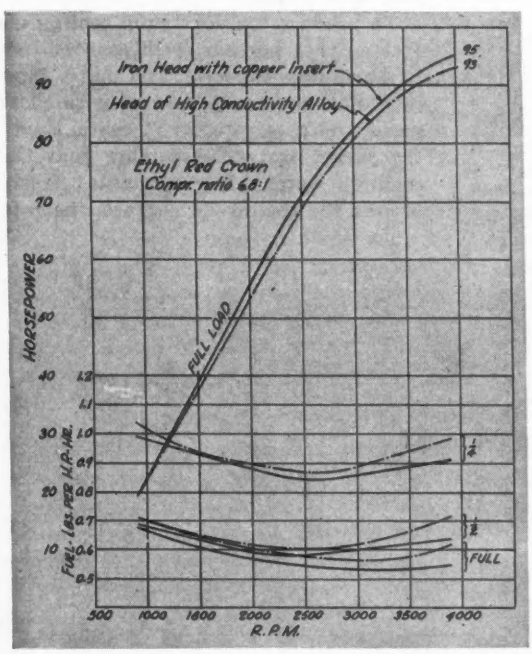
per degree of temperature rise, and aluminum of

$$0.122 \times 2.70 \times 0.30 = 0.178.$$

The ratio of these factors shows copper to be 2.8 times as effective as aluminum as regards absorption and conduction of heat from the plate surface. In other words, the rise in temperature of the surface in contact with the gases will be 2.8 as fast with aluminum as with copper. As a rapid rise in the temperature of this surface is detrimental, it is obvious that copper is much better than aluminum for the inserts. In this connection it is interesting to compare the absorption figure for iron with the figures for other metals, since it has a higher specific heat than copper but less heat conductivity. The absorption factor for iron is

$$0.10 \times 7.86 \times 0.10 = 0.078$$

which shows that copper is 6.3 times as good. The above figures are based on the assumption that heat transfer from the insert to the water is unrestricted in each case. Fig. 7 shows the surface temperatures of copper and iron in the head directly over the piston. Thermocouples were located in holes only 0.010 in. from the surface of the combustion chamber. It is obvious that since the copper is at a much lower temperature, it has a much greater anti-detonating effect. It is interesting to note that the temperature of the copper surface is not much above that of the jacket water. The test was made under full-load condi-



Graph showing horsepower and fuel consumptions of engines with the two types of cylinder head when running on ethyl gasoline

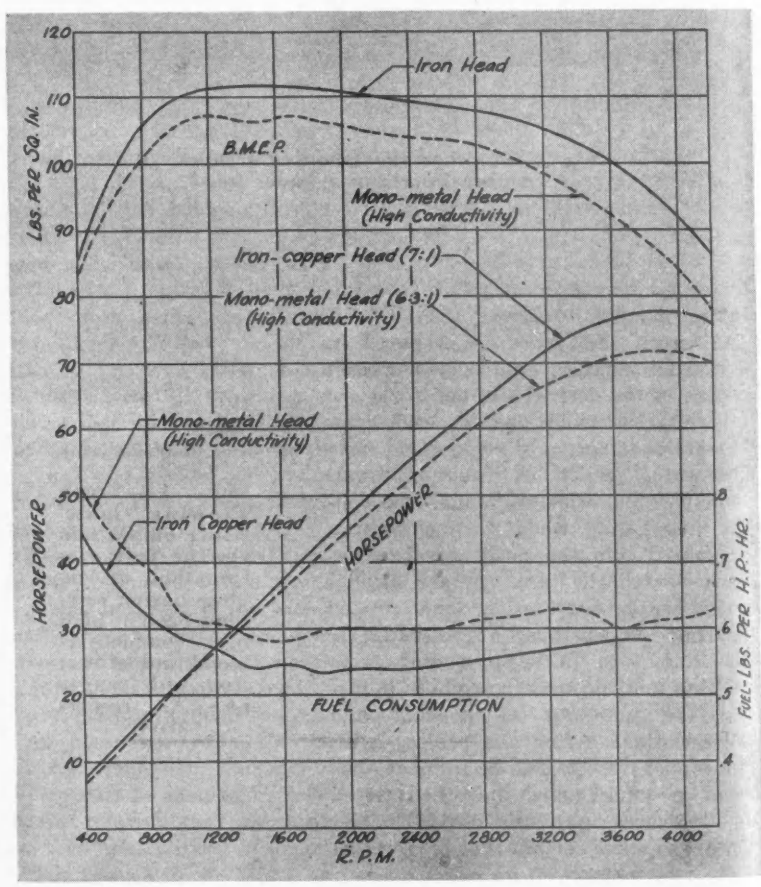


Fig. 6—A comparative test on small six-cylinder engine; iron-copper head designed for maximum smoothness of combustion

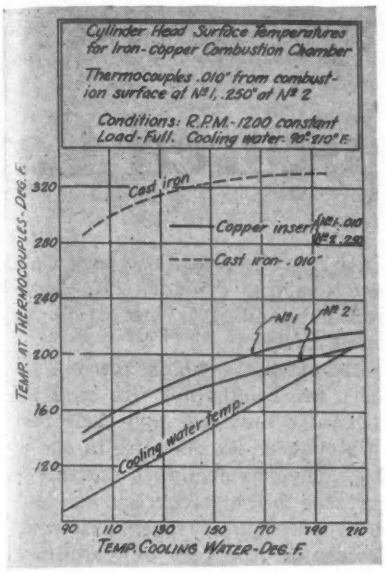
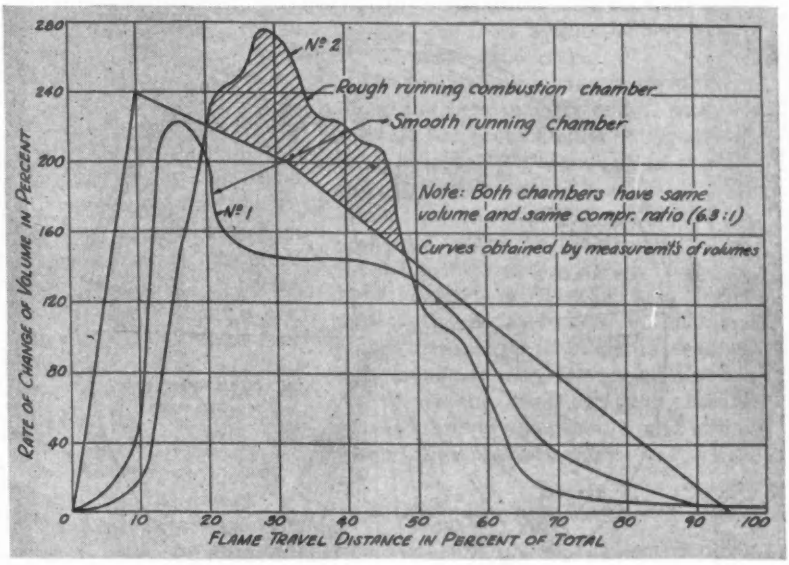


Fig. 7—Surface temperatures of copper and iron in head directly over the pistons

Fig. 8—Rates of increase of volume with distance from ignition point for two combustion chambers of same total volume



tions, with the cooling-water temperature the only variable.

In designing an iron-copper cylinder head for an L-head engine, with a view to obtaining the greatest possible output and economy consistent with good idling and acceleration, the problem generally may be attacked from the standpoint of obtaining maximum combustion smoothness for a given compression ratio. This is so because the power output is generally improved if the engine is free from combustion roughness. By combustion roughness I mean the shock effect when the explosion occurs. If the combustion is completed in too short a time, the high rate of pressure rise subjects the piston and crankshaft to a shock load that may greatly exceed the load due to the actual pressure under static conditions.

The causes of shock ordinarily referred to as engine roughness have been carefully investigated and mathematically analyzed by R. N. Janeway and Alex Taub. In Mr. Taub's work certain fundamentals were graphically illustrated and used as a basis on which to predict the performance of an engine, as regards roughness, by determining the volume distribution with respect to distance from the point of inflammation. We adopted this method in the design of our combustion chambers. Tests we have made on various engines have shown conclusively that this method of comparing the efficiencies of various chamber designs with a view to freedom from roughness has a rational basis.

Examples of combustion chambers designed for smooth combustion are illustrated in Figs. 2 and 3, the volumes over the intake valves being reduced and those over the exhaust valves increased, with the spark plugs located over the exhaust valves. The area of the throat passage is about 1½ times the net area of the intake-valve passage.

Figs. 4 and 5 are graphs of horsepower output and specific fuel consumption of an engine with complete head of high heat conductivity metal and with an iron-copper (insert) head respectively. The tests were made under identical conditions, the compression ratio being the same in both engines. At 3700 r.p.m. there was a gain of about 5 hp. with the iron-copper head, together with a substantial gain in fuel economy. Tests on other engines showed similar gains. The iron-copper head not only gave more power and increased economy, but was decidedly smoother over the entire operating range. Detonation control was appreciably better with the iron-copper head, as shown by the power run on Stanolind gasoline. There was

(*Turn to page 733, please*)

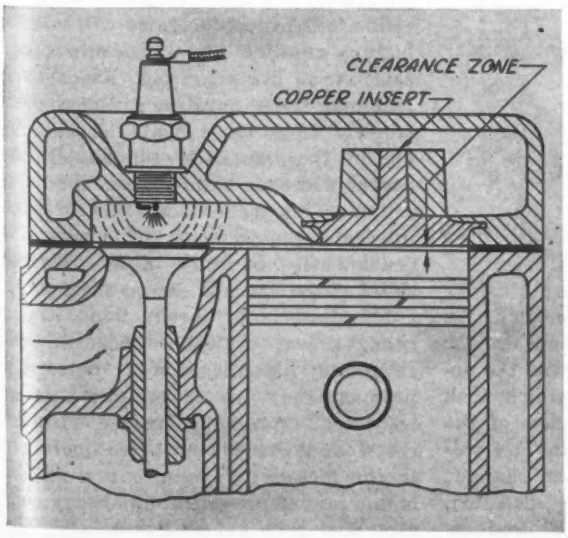
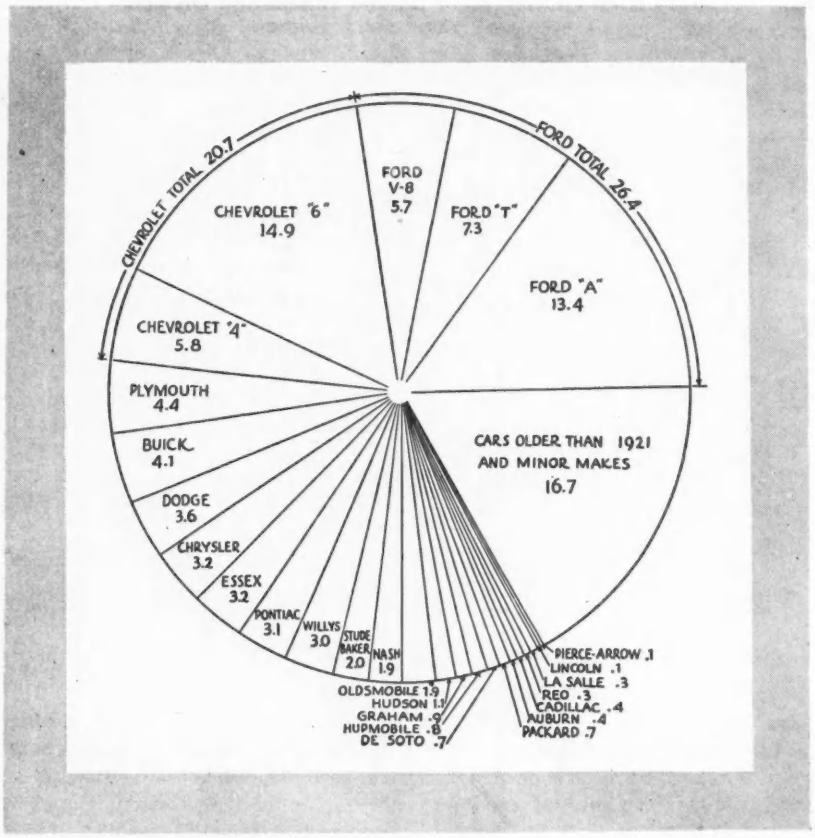


Fig. 9—Sectional view of iron cylinder head with copper insert

Survey Classifies Registered Cars



Cars Registered in the United States—December 31, 1934
All Models, 23 Leading Makes—1921 to 1934 Inclusive

Make	Total	Per Cent on Road	Make	Total	Per Cent on Road
Ford A 2,878,730		13.4	Nash	406,027	1.9
Ford T 1,557,576		7.3	Oldsmobile	400,280	1.9
Ford V8 ... 1,227,055		5.7	Hudson	247,532	1.1
Ford—Total	5,663,361	26.4	Graham-Paige	188,561	0.9
Chevrolet 6.. 3,190,177		14.9	Hupmobile	178,411	0.8
Chevrolet 4.. 1,248,897		5.8	De Soto	158,871	0.7
Chevrolet—Total	4,439,074	20.7	Packard	155,283	0.7
Plymouth	938,751	4.4	Auburn	92,114	0.4
Buick	885,958	4.1	Cadillac	83,007	0.4
Dodge	771,232	3.6	Reo	74,292	0.3
Chrysler	696,588	3.2	La Salle	57,775	0.3
Essex-Terraplane	692,734	3.2	Lincoln	31,300	0.1
Pontiac	669,231	3.1	Pierce-Arrow	30,788	0.1
Willys-Whippet-Overland	633,150	3.0	Cars older than 1921 and minor makes	3,517,899	16.7
Studebaker	433,872	2.0	Total	21,446,191	100.0

FIG. 1—Composition of Gasoline Market, December 31, 1934.

THIS committee was created at the May, 1935, meeting of the Institute, with the general instructions that it was to study changes in automotive design from the viewpoint of possible, or probable, effect on petroleum products. This is obviously an undertaking of no mean magnitude; so the committee offers no apologies in presenting, as the result of its first four months' activity, a report which is concerned more with things that should be done than with those that have been done.

There is one recorded case in history where great changes were made in automobile design to compensate for a change in gasoline. This was the development in carburetion which took place around 1920 to take care of the then considerable decrease in fuel volatility. Practically all other changes have been in the reverse direction, e. g., changes in petroleum products which have been made to meet changes in automotive demand. Of these the most outstanding is that of increased octane rating.

The extent to which automotive vehicles are bought and are used varies with their first cost and their cost of maintenance. An increase in the price of automobiles decreases the sales and decreases the petroleum market, and the reverse is equally true. Likewise, an increase in the cost of gasoline discourages the sale of new cars and decreases the use of existing cars. This means that neither of the two industries should ask the other for changes which will sensibly affect the cost of its products, unless the effect be in the downward direction.

This brings us to a point where a difference in attitude between the automobile manufacturer and the refiner should be specified. The former depends for his income upon the sale of new cars; the latter, upon the maintenance of cars both old and new. The automobile manufacturer wishes to obsolete old cars as fast as possible in order that he may replace them with new machines. The market of the refiner is affected by the number of cars in use, and is but little influenced by the age of those cars.

At the present time, the average car is five years old. The automobile industry expects, in the next few years, considerably to reduce this average age. Present production plans call for replacement at the rate of from 15 to 20 per cent per annum for the next few years; but even if this rather ambitious program is realized, it means that the refiner's *average* customer will still be buying gasoline and lubricants for a car four to five years old. As cars are becoming more durable, it appears extremely improbable that the average age of the cars in use in the United States will ever be much less than five years. This means that the fuel and lubricant requirements of a new car could easily be quite different from those of the average car on the road.

In automobile production rapid changes are desirable because they stimulate obsolesence; in petroleum products they are undesirable because they tend toward increased refinery costs, and consequent price increases to the motorist. The attention of the motor-car manufacturer is always concentrated upon his newest models. The

By Age Groups and Fuel Requirements

First Progress report of Automotive Committee of American Petroleum Institute lists trends of interest to automotive and petroleum engineers and economists.[1]

petroleum refiner has to satisfy not only the owner of a new model, but the much greater number of his customers who are owners of old models. This means a very distinct difference in the viewpoints of the two industries, and it is to be doubted whether the automobile industry realizes the difference.

The first step taken by the Automotive Survey Committee was to make a study of the passenger cars registered in the United States, and Fig. 1 shows graphically the make-up of the refiners' market as it was Dec. 31, 1934, the latest date for which complete registration figures are available. To most people it will be very surprising to see the Model T Ford outnumbering the Ford V-8, and the Model A Ford outnumbering both of them put together. Fig. 2 is a similar chart in which the same cars are divided by age groups.

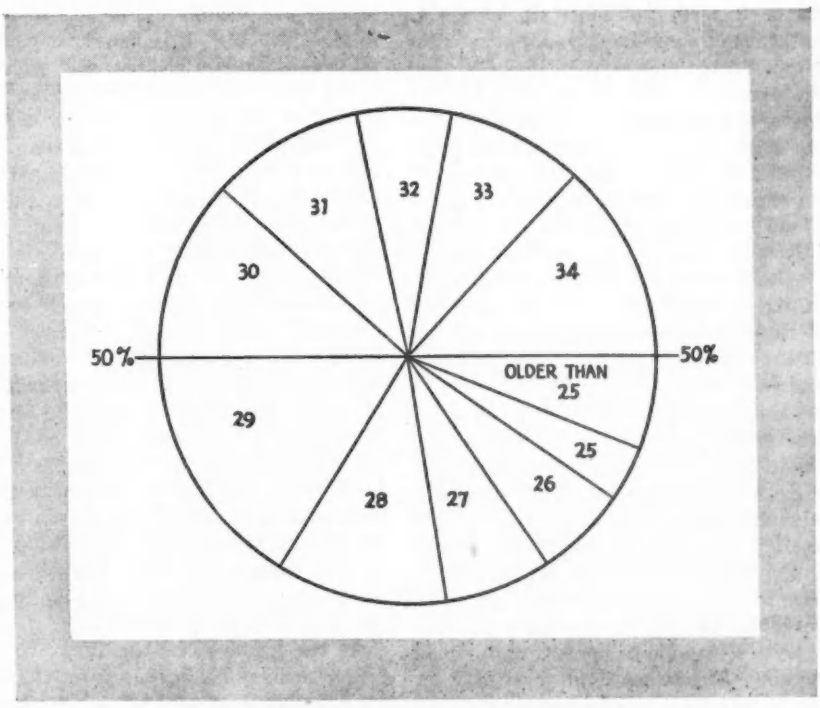
Of course, the major change in automobiles that has affected the petroleum industry has been the demand for fuel of higher octane rating. Almost all cars manufactured in 1935 require a gasoline not much under 70 octane. Most of the cars built in 1934 were in the same class. By contrast, 87 per cent of the cars built in 1931 did not require more than 65 octane. Here is an example of how changes in automobile design have pushed the petroleum industry very hard, and also furnishes the outstanding instance of the petroleum industry's willingness to be pushed.

Nor has this pushing on octane rating reached its end. There has been a sort of indefinite idea permeating the petroleum industry that the engineers are at least temporarily satisfied with 70 octane, and most new cars are nominally designed to use "regular-priced" motor fuel. However, the fact is that the newer engines are mostly designed right up to the limit of smooth performance with 70 octane, so that a very little irregularity in spark advance or a very small amount of carbon raises their octane requirement quite a little above 70. Now there must be an end to this sort of thing. Perhaps in a year or two the fuels that are now 68 to 70 octane will have become 70 to 72; but, if this happens, and if the designers again raise compressions, the petroleum industry probably will not be able to go still further—not without a very real increase in the price of motor fuel! Each step we take upward in the octane scale is steeper and harder than the step before. While the day may come when 80 octane can be made as economically as is 70 octane at present, it is equally likely that this never will happen. Putting it another way, if we ever do discover how to make 80 octane at the present cost of 70 octane, then it is almost axiomatic that we would be able to make 70 octane at less cost than today. So the automobile engineer should remember that while the petroleum industry has been a very willing horse, there is still a limit to the load the most willing of horses—or of partners—can carry.

The proportion of cars requiring over 70 octane is extremely small, actually only 1.4 per cent of all cars registered. Even this small percentage is due almost entirely to a single make of poor combustion chamber design. Three hundred and twelve thousand cars out of the 21½ million registered Dec. 31, 1934, needed over 70 octane and 250,000 out of the 312,000 were of this one make. Other cars of better mechanical design operate with perfect satisfaction on 68 octane fuel although having actually higher compression and giving much better fuel economy.

Volatility Requirement

About 1920 almost the only kind of gasoline available—and that at a relatively high price—was of the lowest volatility in history. The automobile industry was not slow in realizing that



Out of every 100 cars on the road:

13 were built in 1934	11 were built in 1928
9 were built in 1933	7 were built in 1927
6 were built in 1932	6 were built in 1926
10 were built in 1931	4 were built in 1925
12 were built in 1930	6 were built before 1925
16 were built in 1929	

FIG. 2—Cars on the Road, as of December 31, 1934, Classified by Their Age.

[1] Presented by A. Ludlow Clayden, Sun Oil Co., at the Annual Meeting of the American Petroleum Institute, Los Angeles, Nov. 11-14.

its own future depended upon its ability to meet the situation by engineering changes. This it did, and did quite promptly. The reason for the drop in volatility between 1914 and 1920 was the stupendous increase in demand for gasoline. Since 1920, however, the petroleum industry has not only restored the volatility of pre-war days, but is capable and desirous of going still further. If it were not for restrictive features in automobile design, the petroleum industry within a few months could greatly improve the starting and accelerating qualities of motor gasoline, somewhat increase octane rating, and at the same time effect substantial economies in the cost of refining and in the volume of crude oil required per gallon of gasoline.*

This leads to another difference between the two industries. The automobile manufacturer can put on the market at least a certain number of cars of which the fuel and lubricant requirements can only be met from exceptional sources of supply; because it has been the experience of the automobile industry that, when this is done, the exceptional product of today becomes the normal product of tomorrow. The reverse of this is not possible. The petroleum industry cannot make fuels which will operate only in a limited few among automobiles.

The great improvement in motor-fuel volatility, which is immediately realizable if it were not for the restrictive influence of some cars, would benefit the owner of the older car even more than the owner of the new one. The oil-industry's average customer who is driving a car five years old could use more volatile gasoline—and, therefore, by supplying it the petroleum industry would be acting to benefit its average customer. However, many cars built in the last six years simply will not run on highly-volatile fuels; so the majority of car owners are being denied a boon because of the shortcomings of certain models.

There is another way of looking at this same situation which makes the conclusion even more surprising. It has been stated that it is the mechanical limitations of certain cars which restrict improvement in gasoline volatility. Of the cars manufactured in 1934 and in 1935 about 60 per cent, including two of the largest productions, are capable of operating on fuels far above the average in volatility. In Fig. 1, which shows the make-up of the gasoline market, it will be noticed that, after the first four makes of car, none even reaches 4 per cent of total registrations. It is among these smaller productions that we find several makes, with otherwise excellent and well-deserved reputations, which are the main factors in restricting volatility improvement. Of all the cars in use, new and old, about 22 per cent will only run on fuel of low volatility—and most of these can, at very small expense, be modified so as to remove this drawback. Such being the case, it certainly seems that the petroleum industry is not justified in withholding from 78 per cent of its customers an improvement in which they would rejoice. Yet this is exactly the situation in which we stand today.

Summing up, the average regular-price gasoline today has an octane rating only required by, and only appreciated by, less than 30 per cent of the cars in which it is used. Such gasoline unquestionably costs slightly more to produce than fuel of 65 octane, which would completely satisfy the rest of the market. Simultaneously, we are unable to provide volatility which would be realized instantly by 78 per cent of our customers because of the shortcomings of about 22 per cent of the cars on the road.

Volatility Future

The present volatility situation is bad enough as thus expressed, but actually it is even worse than appears at first glance—and the future is distinctly not encouraging. A very large amount of research work on vapor lock, mainly financed by the oil industry, uncovered the mechanical causes of difficulty which were, of course, increasing temperatures in the fuel system. A gasoline pump can suck from the rear tank and deliver to the carburetor anything that is liquid and also a certain amount of bubbles in vapor. The only fuel which can be used in the engine is that which is delivered in liquid form to the carburetor; any vapor created in the fuel line is lost from the carburetor bowl. By redesigning the pump so that it will handle a larger proportion of vapor, and by increasing the size of the vents on the carburetor bowl, we may still have fairly high temperatures throughout the fuel system and yet not encounter vapor-lock troubles—but only at the cost of wasting considerable fuel in the form of vapor. Furthermore, under such conditions the gasoline in the carburetor is much less volatile than the gasoline in the tank; so the driver derives no benefit from the better gasoline, because the fuel is debased before it reaches the engine.

In order that there may be no misunderstanding, let it be made clear that this waste of the more volatile portions of motor fuel is taking place now, with gasolines as they are today. It would be very much worse if volatility were improved as it ought to be improved. The case as stated sounds absurd—and it is absurd; but the automobile engineer, while deserving of a good deal of blame, is also worthy of a good deal of pity.

About four years ago, when the importance of keeping fuel lines and gasoline pumps cooler was first made evident, improvement in this particular respect did take place. All the best-known makes which had badly laid-out fuel systems in 1930 or 1931 are very greatly improved today, but during this same period body designs have changed in a way which confines the engine under much closer fitting hoods and places them behind smaller radiators; so that even faster than the engineers have been able to improve fuel system layout the temperature of the air under the hood has increased so that gasoline boiling (which used to take place in the pump) has been transferred to the carburetor bowl, and is worse there than it was in the pump before any changes had been made. In some of the 1936 designs we can see the dim beginnings of effort in the direction of cooling the fuel system, carburetor included; but it is very disheartening that we are still hardly any better off after three years of effort to persuade the engineers how they are acting against their own best interests and against those of their customers.

History has shown that the automobile industry can adopt improvements very rapidly when they are proved to be improvements. Why it refuses to act in this instance remains an unsolved mystery. There is every reason to anticipate that the next several years will be a period of very high production of new cars, because the decrease in buying during the depression has created an exceptionally large replacement market. Estimates of production for 1936, as the time of writing this report, are between five million and six million cars. If these cars, and those to be produced in 1937, are not all of them much better than cars of 1934 and 1935, then the day when we can provide the public with easier starting, better accelerating, and more economical motor fuel is unduly postponed—and the car owner is the principal sufferer.

Motor Oils

While cars have always been sensitive to gasoline characteristics, they have not until recently become similarly sensitive to motor oils. As long as the viscosity was somewhere within fairly wide limits, the performance of the engine would be essentially the same with a great variety of oils. A high-compression car is instantly robbed of its performance unless given fuel of adequate octane rating, but we have

* R. C. Alden, "Butane—A Wasted Asset of the Petroleum Industry," *Proc. A.P.I.*, 15M (111) 74 (1934).

had no cars with which the performance depended upon special lubricating-oil qualities.

However, within the last two years a new situation has arisen; new bearing metals are being employed, and it has been found that these metals are subject to corrosion if inexpertly used in conjunction with motor oils of certain chemical types. Refiners have been striving to produce motor oils more and more resistant to oxidation—and some of these oils, generally regarded as very high-quality products, appear to be unsuitable for use with the new bearings.

This situation has been well known for over a year. It was precipitated by just one make of car which started to employ these bearings in its 1935 model. Oil temperatures in this car rise to exceptional heights, and it has been amply proved that bearing corrosion will not occur with these new metals if oil temperatures are restrained to a reasonable maximum—say, 250 deg. F. It is positively dismaying to find the 1936 model of this same car only very slightly improved. How bad this situation is can hardly be believed by anyone not familiar with the case. For instance, 500 miles of fairly high-speed driving, using some oils regarded as nearly ideal for all other cars, is sufficient completely to destroy a set of connecting-rod bearings. Oils exist which do not react corrosively with these bearings; but, with a few possible exceptions, they are not types desired by all other car manufacturers and by automobile users.

Similar bearings are being used by other makers with great success—apparently because in these other cars oil temperatures are reasonable. Yet the petroleum industry has heard stated the suggestion that all motor oils should be changed to permit this one car to continue to use exactly the type of design it has at the moment. This make of car represents substantially less than 4 per cent of the cars on the road, including all its models both old and new.

There is only one proper attitude for the oil industry to take, which is that bearing troubles in this car are due to faulty engineering. The less we are willing to help out the situation, the more quickly will it be cured. The motor oils today recognized as high-quality products are enormously better than the motor oils of 10 years aro. Engines should be designed to take advantage of their qualities, just as modern designs take advantage of new qualities in gasoline.

There is good reason to believe that the new bearings, when suitably employed, are a distinct improvement in that the rate of wear is reduced considerably. There is plenty of evidence to show that the corrosion does not occur if oil temperatures are prevented from rising very high. Consequently, while our knowledge on this subject is inexact, it does appear that the difficulty is overcome when oil temperatures do not exceed a maximum of perhaps 250 deg. F. Right here we run against the same difficulty that occurs in volatility limitations, viz., that the temperature of the atmosphere surrounding the engine has increased a great deal. The confined space makes the introduction of an efficient oil cooler a major problem—and, of course, the cost of an oil cooler will always be a consideration.

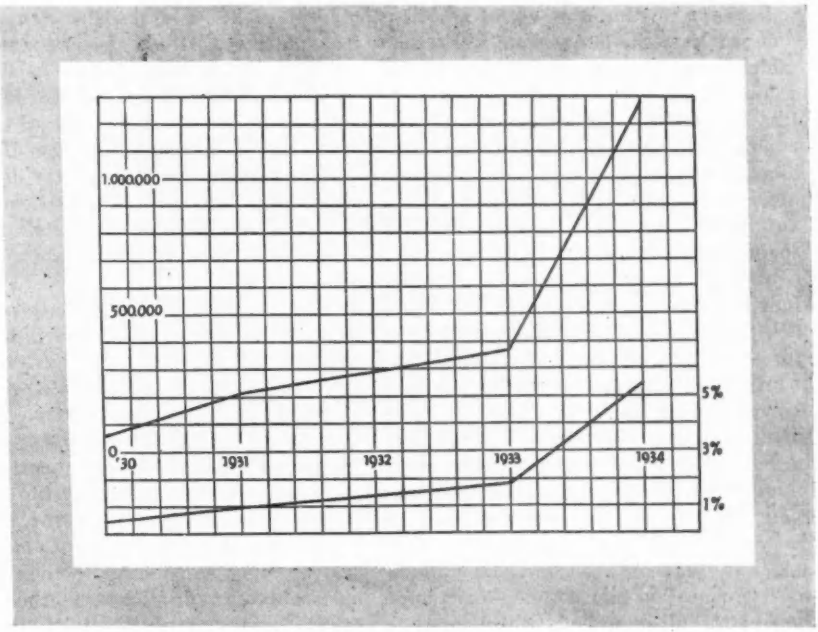


FIG. 3—Growth of Cars Carrying EP-Lubricant Recommendations.

This is an automobile engineering problem entirely. It has frequently been said, and said with truth, that the average motor oil is a great deal better than the average engine. By which is meant that modifications in engine design that would reduce oil temperature and lessen some minor forms of contamination could do far more to prolong oil life than any conceivable thing that could be done to lubricants. There is good reason to hope that the engineers will solve this problem mechanically fairly soon, especially since some of them appear to have done so already.

Extreme-Pressure Lubricants

There were manufactured in 1934 well over a million cars for which the use of EP lubricant was specified. This figure has been considerably exceeded this year, and will be still greater in 1936. The automobile industry is moving over to rear-axle types which call for this kind of lubricant, just as it changed compression ratios and called for high-octane fuel. We are about in the same position today with respect to EP lubricants that we were five or six years ago with respect to octane rating, and it is apparent that practically all gear lubricants will have to be of EP type just as practically all gasolines have had to come up to 70 octane number.

A parallel also holds true with respect to cost, since an EP lubricant must, of its very nature, cost more to produce than a straight oil. This EP situation has developed slowly. Cooperation between the two industries in the development of, and in the means for, testing lubricants of this type began a good many years ago—and no heavy pressure has been put upon the oil industry. In addition, very many of the cars for which EP is specified will function satisfactorily on simpler lubricants—at least unless driven in a very violent manner. This means that the petroleum industry has been given ample time to get ready for a coming change. It has not been asked suddenly to furnish large quantities of previously non-existent material.

This has been of very real service to the automobile user, because the art of making EP lubricants was something that had to be acquired. The motorist today is sure of getting a satisfactory EP lubricant from any reputable source of supply. If, however, six years ago there had occurred a sudden demand for EP lubricants in large quantities, there would undoubtedly have been put upon the market much material which would not have given satisfactory service.

Perhaps this happy state of affairs is due partly to the almost comic situation which arose over the free-wheeling development. Free wheeling appeared like a comet in the sky. Like all mechanical devices of which the development is rushed, the early free-wheeling units were not properly designed. The automobile engineers, being forced by their sales departments to adopt a doubtful device, demanded special lubricants—believing that such would help to reduce the troubles which they foresaw. The oil industry stepped forward and provided special oils; but, almost before they were well distributed, it was discovered that free wheeling did not really require anything abnormal in the way of lubrication. Today free wheeling appears to be vanishing, while undoubtedly there are hundreds of thousands of gallons of free-wheeling oils lying in dead storage in the oil-industry's warehouses.

Future Developments

The two cases cited, those of EP lubricants and free wheeling, offer a perfect contrast of the right and the wrong way to handle problems common to the two industries. It is hoped that in some way, perhaps through the activities of the Automotive Survey Committee of this Institute, we shall see more developments conducted in the best way. Very much the biggest problem is how to obtain the engineering changes to open the road for improved motor fuels. In the few months the Automotive Survey Committee has been in existence, it has endeavored to collect—purely from refinery laboratories—data on the behavior of cars of different makes and models with respect to volatility. It has been found that, while a great mass of data exists, correlation is almost impossible—due not only to difference in methods of testing, but due to the fact that the different laboratories have had slightly different objectives. The committee believes that this study should be undertaken in a comprehensive and thoroughly organized manner.

The work done at Uniontown, and also in individual laboratories, has developed an excellent standard method for evaluating an automobile with respect to its octane sensitivity. We do not need to run group tests of the Uniontown type to devise a method for rating the volatility factor, but we do need a method. This committee, the Cooperative Fuel Research Committee, and possibly some other bodies in cooperation, can develop a method very easily—and, having obtained one, the collection of exact and correlatable data can proceed rapidly.

The laboratories of the oil industry are the places where new cars should be tested and evaluated for characteristics that affect their petroleum-product requirements. This is because in these laboratories we find the suitable viewpoint. The automobile engineers would certainly welcome such testing if it were conducted in a systematic manner.

From the large amount of data turned in by the members of this committee, it is obvious that nearly every laboratory has been using cars to test products. We want to reverse this procedure, and use products to test cars. For example, we find a certain car will have vapor lock if given fuel above a certain vapor pressure. But this is only the first step—and in studying the car, we should then find out the reason for the limitation and, if possible, what modifications in design would effect an improvement.

Let it be remembered that along exactly these lines a great deal has been learned about octane sensitivity. We know that certain forms of cylinder head are good, and that certain other forms are poor. We have learned a great deal about the importance of spark-plug location. In these instances the laboratories of the two industries have cooperated extensively. Now in this immediate and extremely vital problem of volatility it is up to us to make the next organized move; and if we do so, we shall undoubtedly secure the same wholehearted cooperation from our sister industry.

This progress report is an attempt to outline the situation as it appears today. With respect to the future, the committee's conclusion is that great good might be done by organized testing of automobiles—of course, making available to the automobile industry the results of such organized tests.

The committee wishes to acknowledge with thanks the cooperation of the Chilton Company, publishers of *Automotive Industries*, in supplying statistical data.

(Of two appendices issued with the report, the first covered the volatility situation a little more fully than the body of the report, while the second gave statistics on extreme-pressure lubricant recommendations and on free-wheeling.—Editor.)

Further Details of Houde-Carrier Air-Conditioning System

FOLLOWING are some additional details regarding the Houde-Carrier air-conditioning system of which a description appeared in our issue of Nov. 2.

The compressor, located adjacent to the engine and driven from the latter, serves to create a pressure difference between the air-cooling coils and the refrigerant condenser. The compressor creates a vacuum in the air-cooling coils and delivers the gas to the condenser at a slightly higher pressure. From the condenser the cooled refrigerant is conveyed to the liquid receiver, and from the liquid receiver it is conveyed to the air-cooling coils. The compressor maintains the circulation of gas and liquid through the system.

The liquid receiver is located near the compressor but is not a part of same; it is included in the circuit between the condenser and the air-cooling coils. The air-cooling unit is in reality the evaporator of the refrigerating system. When air is cooled and dehumidified by passing through the air-cooling or evaporator unit of the system, condensation of moisture takes place on the air-cooling surfaces; this condensation is collected at the bottom of the air-cooling unit and is drained to a point outside the bus. This drain is continuous. The air is dehumidified considerably below the saturation point of air at the outside temperature.

Patents

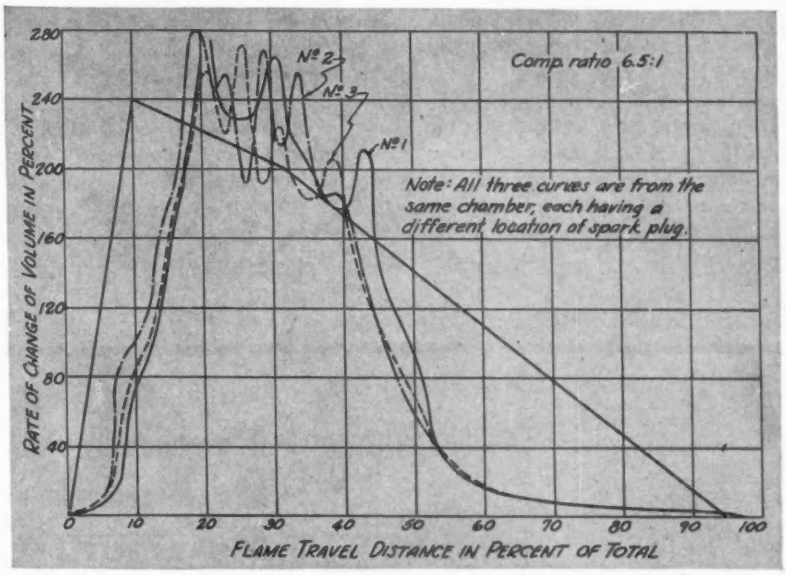
Patents, by Everett G. Wright, Patent Attorney. Published by the Patents Publishing Company, Detroit, Mich.

THE object of this little book is to present a precise statement of the fundamentals of patents in such a form that the executive, engineer, inventor or attorney, without the expenditure of unnecessary time, may apprise himself of such facts as will enable him to safeguard his interests in patent matters and more fully cooperate with his patent attorney. The book contains eight chapters and the following chapter heads give a good idea of the subjects covered by it: Patents in General; Invention, Novelty, Utility and Abandonment; Protecting Inventions; Scope of Patent Protection; Prior Art, Validity and Infringement; Patent Applications; Rights of Parties, Employment Contracts; Assignments, Licenses and Royalty Contracts.

Iron and Copper Make Ideal Cylinder Head

(*Continued from page 727*)

Fig. 10—Some curves throwing further light on combustion chamber characteristics



no gain in power with ethyl gasoline in the engine with iron-copper (insert) head, while in the engine with complete head of high conductivity metal there was. This further supports the contention that there is less tendency to detonation with the iron-copper head.

In tests referred to, the spark was set for maximum power in each case, but no adjustments were made on the carburetor. Test results were corrected for deviations from standard atmosphere (pressure, temperature and humidity). Some of the increase in power may be due to an improvement in the form of the chamber, but most of it is no doubt due to the effect of the copper in suppressing detonation. Fig. 6 shows a comparative test on a small six-cylinder engine, the iron-copper head being designed for maximum smoothness of combustion.

In adapting the copper insert to a particular combustion chamber, it is generally necessary to redesign the chamber to reduce the roughness characteristics common to many current designs. The location of the spark plug has a strong influence on the time taken for complete combustion and the location and temperature of the gas last to burn in the chamber. For example, if the plug were located in the "clearance zone," the proportion of fuel burned within this zone would be a minimum, and one would have no control over detonation even though copper were used in the head as the last gas to burn would be over the valves and at a high temperature. Fig. 8 shows the rates of increase of volume with distance from the point of ignition, for two combustion chambers of the same total volume, curve No. 1 applying to a chamber giving smooth combustion, while No. 2 is from a rough chamber. These curves were obtained by making plaster casts of the respective chambers and plotting the proportional volume increase against the proportional flame-travel increase.

In designing for smoothness, it is necessary to get the peak value of the curve as early and as low as possible. This is generally determined by the location of the spark plug, but quite often the volume distribution will upset the calculations, and changes will have to be made in the shape of the chamber. It is quite hopeless to try to predict volume distribution accurately, and generally a number of attempts are made before a design is finally accepted. The final check is always on the engine, but so far the engine tests have always substantiated predictions from our graphical analysis as far as roughness is concerned.

Some further light is thrown on combustion-chamber characteristics by the curves of Fig. 10. The chamber from which these curves were obtained appeared to be a good one, but it turned out to be a complete failure. We made several attempts to improve its characteristics by shifting the spark plug in various ways, but the resulting graph in each case showed three peaks, which would no doubt have resulted in rapid pressure accelerations during combustion. A test on an engine might give a raspy or sandpaper noise in the engine and make it almost impossible to provide a spark timing that would assure a satisfactory output at all speeds. It might also lead to resonance in the chamber that would amplify gear noises at certain critical car speeds. This chamber had to be abandoned.

While it is impossible as a rule to change a poorly-designed combustion chamber into a good one by merely changing the plug location, a good chamber can be spoiled by improper lo-

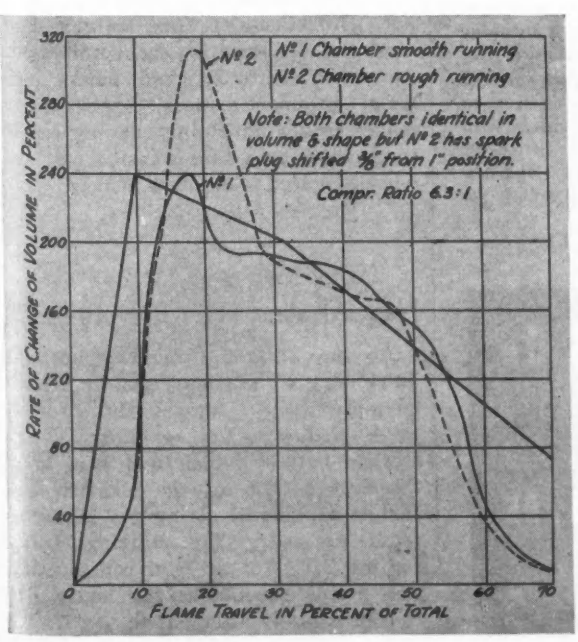


Fig. 11 — Effects of a change in plug location on roughness characteristics of a combustion chamber. Curve No. 2 is from the same combustion chamber as curve No. 1, but the spark plug had been moved 3/8 in. from the original location.

cation of the plug. This is illustrated by Fig. 11, in which curve No. 1 is from a good chamber and No. 2 from the same chamber with the spark plug shifted ⅝ in. from its original location. Engine tests of these cylinder heads showed that No. 2 was distinctly rough while No. 1 was smooth, even though ignition in it occurred 5 deg. earlier than in No. 2. The later setting of the spark in No. 2 indicates more rapid combustion in this chamber, which involves rough operation. Note that both graphs are quite similar beyond the peak.

API-SAE Coast Meetings

(*Continued from page* 723)

the necessity for suitable fuel, especially clean fuel. He showed a very interesting motion picture taken of tractor operations in almost all parts of the world. In the factory, the operations of making the fuel injectors were demonstrated, and the effects upon injectors of dirty fuels also shown by a microscope.

Of course, the bridge trip had but little to do with strictly S.A.E. activities. It was arranged by Harry Laufer, a local member, through the courtesy of J. L. Clymer of the San Francisco Chamber of Commerce and Chief Engineer Purcell of the bridge construction. Some 90 members were taken on a government tug to Buena Yerba Island in the middle of the bay, where the operation of spinning the cables could be inspected on one side of the island, and that of throwing out the biggest cantilever ever attempted seen on the other side.

Tremendous efforts are planned to convince the S.A.E. that the proper place for the 1938 summer meeting is in this city, coincident with the exhibition. If the abilities of the California sections in running a regional meeting can be taken as indicative, then a national meeting here should be something to remember forever.

London Truck Show

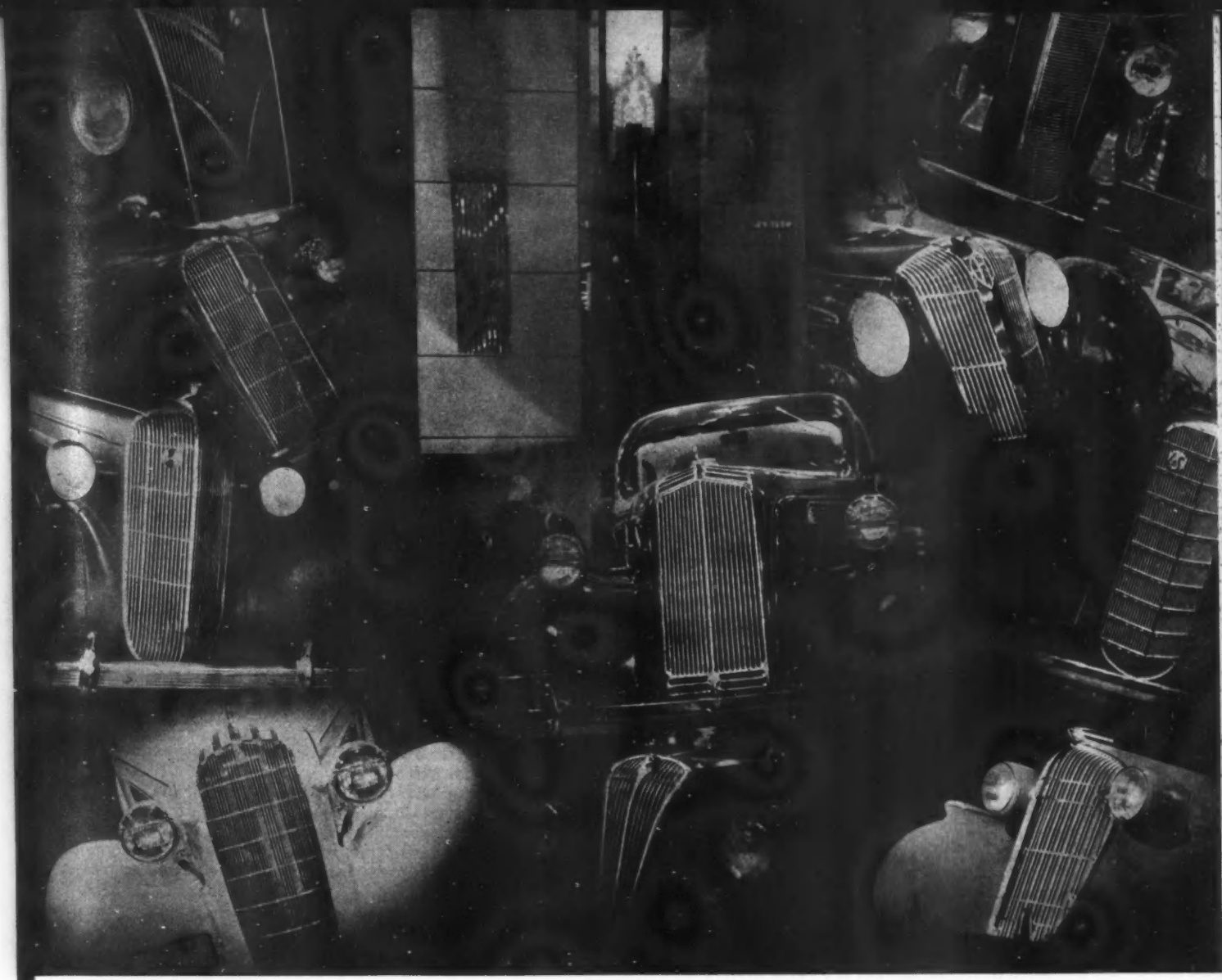
(*Continued from page* 719)

b.h.p. in the case of the new engine. The latter occupies only two-thirds of the space of the "in-line" engine.

Olympia contains a number of makes of "trolley buses," six prominent motor bus manufacturers having added this hybrid type of vehicle to their range, owing to the increasing demand for it to displace tramcars on rails in numerous British towns and cities, including London. It is, in effect, a motor bus chassis with electric drive taking current through dual trolley arms from overhead cables. In steering, brakes, frame, axles and final drive it is a motor bus, with the engine and gearset displaced by an electric motor. It is made as both four-wheeler and six-wheeler (with two-axle drive) and is produced by A.E.C., Crossley, Guy, Karrier, Leyland and Sunbeam among motor manufacturers, and by Ransome among electrical equipment makers. Sunbeam now makes trolley buses only, having ceased to produce both four-wheeled and six-wheeled gasoline-engined models.

New Alkaline Type Battery

At the Shipping, Engineering and Machinery Exhibition recently held in Olympia Hall, London, the firm of C. A. V.-Bosch, Ltd., exhibited a new storage battery which was said to be the first battery of the alkaline type that is capable of giving the high currents necessary for starting Diesel engines. It is of all-steel construction, and no damage from the heavy discharge rates is anticipated.



T'S THE NEW "FRONT END" STYLING

"Improved appearance" was the most universal claim at the 1935 Automobile Show. And the most universal new design feature was the ZINC Alloy Die Cast radiator grille. Die castings give these new cars an appearance of solidity, a structural integrity, which they have never gained by any other method of fabrication. The possibility of ZINC Alloy Die Castings doing an equally important job for you should be carefully investigated.

The Research was done and
The Alloys were developed with
HORSE HEAD SPECIAL ZINC
(99.99+% Uniform Quality)
Most Die Castings are specified with this metal.

THE NEW JERSEY ZINC COMPANY

60 FRONT STREET — NEW YORK CITY

AUTOMOTIVE ABSTRACTS

Supercharging

A CORRESPONDENT writing under the nom de plume "Technician" points out that it is unwise to attempt to get racing car performance by providing stock cars with superchargers. One reason the racing cars can use very high supercharge (28 lb. per sq. in. in the case of the M.G. Midgets) is that they use specially doped fuels which not only suppress detonation but also tend to keep the valves cool. The most popular Continental supercharged cars as supplied to the public have supercharge pressures of from 2 lb. to 6 lb. only, while American cars have less than 2 lb., and even this comes into operation only at high engine speeds.

If by supercharging a substantially larger than normal charge is forced into the combustion chamber, then the chamber must be enlarged to prevent detonation due to over-compression, and it is here that the matter of compromise comes in. An enlarged combustion chamber proportionate to the increased engine requirements at full throttle naturally produces a lower compression ratio and therefore reduced compression of the charge under part-throttle conditions. The power developed by a given amount of fuel being proportional to its compression at the moment of ignition, low compression means both high fuel consumption and lack of "vim" under normal road-use conditions. With a car of reasonably good power-weight ratio, really full throttle is used comparatively little.

Therefore, a moderate supercharge is all that is desirable, and with from 4-5 lb. per sq. in. average an increase of from 30 to 35 per cent increase in power is obtained which, as only a few pounds is added to the whole, obviously will give immensely improved performance. — *The Autocar*, July 26.

Iron Carbonyl

IRON CARBONYL has long been known for its anti-detonating properties, and many experimental applications have been made of it, concurrently with the use of lead tetra ethyl. However, owing to its instability it has not come into extensive use so far.

In *The Refiner* for February Mr. Leahy reviews the present state of knowledge regarding iron carbonyl. There are several types of this compound, characterized by the following chemical symbols: $Fe(CO)_4$, $Fe(CO)_5$ and $Fe_2(CO)_9$. The most important of these from the anti-detonating standpoint is the second, the iron penta-carbonyl. Its processes of manufacture are quite numerous, but they are all based on the action of carbon monoxide on iron in the reduced state. It is a viscous oil which is soluble in gasoline, benzene and alcohol, but not in water, which latter decomposes it quite freely with the liberation of carbon monoxide. This explains its poisonous character. The decomposition is accelerated by light, and it takes place even in very dilute solutions.

Even traces of iron carbonyl can be readily recognized in gasoline or any other solvent by treatment with potassium ferro-cyanide, which results in the formation of Prussian blue. The anti-detonating properties of iron carbonyl are such that an addition of one part per 1000 increases the octane number from 58 to 96. A gasoline thus treated must not be exposed to air or light, as that would cause it to lose its anti-detonating quality. Numerous products have been recommended for use as stabilizers, such as certain organic acids, esters, amines, chloroform, carbon tetra chloride, etc., but it seems that so far no really efficient stabilizer has been found.—*Le Génie Civil*, Aug. 31.